FUNCTIONAL SERVICING REPORT

IN SUPPORT OF AN OFFICIAL PLAN AMENDMENT

AND ZONING BYLAW AMENDMENT APPLICATIONS

Loon Avenue Lands

Proposed Townhome Community

City of Barrie, Ontario

counterpoint ENGINEERING

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Prepared For:

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EXECUTIVE SUMMARY

This Functional Servicing Report has been prepared on behalf of Loon Avenue Lands OP Inc., the registered owner of the subject land.

The servicing strategy for the proposed development is summarized as follows:

WATER SERVICING:

There is an existing 150mm ø watermain running along Loon Avenue to the north of the site that transitions to a 200mm ø watermain before connecting into an existing 300mm ø watermain on Huronia Road to the west. The adjacent proposed 521 Huronia Road development on the west of the subject site proposed to connect to the existing 300mm ø watermain plug on Huronia Road and the adjacent development proposes a looped connection to Loon Avenue through the northwest corner of the subject site. Water servicing for the proposed development will loop internally and connect in two locations to the watermain proposed as part of the 521 Huronia Road development.

The proposed development will be serviced through a connection to the existing 150mm ø watermain on Loon Avenue and connection to the proposed watermain in the northwest corner of the site provided by the development of the adjacent 521 Huronia Road lands. The watermain through 521 Huronia Avenue connects into the existing 300mm ø watermain on Huronia Road. A 200mm ø watermain network is proposed internally to service the site. Based on the watermain analysis prepared, the proposed watermain system will have adequate flow and pressure to service the proposed development under all applicable conditions including max day, peak hour, and max day + fire flow. The proposed water distribution system for the development shall adequately provide max day + fire flow demand while maintaining a residual pressure of over 140 kPa, as per the Fire Underwriter's Survey. Therefore, no external upgrades or retrofits are anticipated for the existing surrounding watermain network to service the proposed development.

SANITARY SERVICING:

There is an existing 250mm ø sanitary sewer on Loon Avenue beginning at a manhole located on the intersection at Huronia Road and drains from west to east. There is an existing manhole located approximately 180m east-northeast of the site on the adjacent City owned property with a west invert of 236.21. The site does not currently have any available sanitary sewer connection nor any available local sewer along the frontage.

The site will be serviced by an existing sanitary manhole located approximately 180m east-northeast of the site on the adjacent City owned property. The proposed peak design flow from the subject site to the existing 250mm sanitary system is **2.82 L/s**. Based on review of the available sanitary design sheet for the subdivision, the local sewers downstream to the Lover's Creek Trunk sewer have adequate capacity to accommodate the subject site.

STORMWATER SERVICING:

There is currently no storm servicing infrastructure in the vicinity of the subject site. The nearest storm system consists of an existing 450mm ø storm sewer on Loon Avenue flowing west to east that drains into an existing 750mm ø storm sewer downstream. The proposed residential development will be serviced through surface conveyance and a minor storm sewer system. Stormwater flows will be directed south towards the existing wetland.

The proposed site release rate during the 100-year storm event will be controlled to the maximum allowable release rate of 110 L/s. This results in **370m3** of required storage within the site. The required storage will be provided by the green storm module system or stormtech chamber system.

Quality control will be provided by the proposed Stormfilter cartridge system that is equipped with PhosphoSorb media that shall provide the necessary stormwater treatment, including 80% TSS, phosphorus, oil, grease, and heavy metal pollutant removal. The Phosphosorb will provide 79% phosphorus removal as per ETV testing results.

The resulting phosphorus offsetting cost is as follows:

0.67 kg/yr x 2.5 offset ratio x $35,000 kg/yr = $58,625
Total Cost = $67,418.75

Volume control will be provided by the stormtech chamber isolator row meeting a minimum filtration treatment volume of 5mm from all impervious areas. Infiltration potential from the stormtech chamber is to be explored in areas of significant engineered fill when 1.0m groundwater separation from the stormtech chambers can be achieved.

The Water Balance Offsetting Fee has been calculated assuming infiltration will not be possible and can be revisited pending confirmation of the high groundwater table. Based on the fee schedule, the calculation is as follows:

1688 m^3/year x $44.97 costs/$m^3$ = $75,909.36;
Administration Fee = 15% x 75,909.36 = $11,386.40
Total Fee = $75,909.36 + $11,386.40 = **$87,295.76**

In accordance with the offsetting policies, the greater of the Water Balance Offset Fee and the Phosphorus Offsetting Fee with be payable. For the contemplated development proposal it is expected that the Water Balance Offsetting Fee will be payable.

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1.0 INTRODUCTION

1.1 Background

This Functional Servicing Report has been prepared on behalf of Loon Avenue Lands OP Inc. in support of an official plan amendment and zoning bylaw amendment applications for the proposed 5 acre Loon Avenue Townhome Community. The total gross area of the subject lands is 11.57 ha (28.59 acres) and the developable land area is 2.56 ha (5 acres). This application proposes to construct a new townhouse development. The purpose of this report is to demonstrate that the existing infrastructure within the surrounding area can accommodate the proposed development. The remainder of the site will be designated as Environmental Protection (EP) lands. The calculations in this report will be based on the proposed developable area of 2.56 ha within the proposed development limit.

The subject site lies within the City of Barrie. It is in the southeast corner of Huronia Road and Loon Avenue. The site is bounded by single detached dwellings along Loon Ave to the north, undeveloped forest area to the east, and undeveloped forest/wetland to the south and west. **Figure 1 – Site Location** illustrates the subject site within the context of its surroundings. The proposed Loon Avenue Lands Townhome Community consists of 105 townhouse units, a proposed driveway, surface parking, and landscape features as shown on **Figure 2 – General Plan**. The proposal includes a 5.0m buffer from the limit of the wetland.

The existing site primarily consists of treed and wetland areas. The site generally slopes from northwest to southeast, as identified on **Figure SWM-1 – Pre-Development Drainage Plan**.

1.2 Study Parameters

This servicing assessment is based on:

- Topographic Survey, prepared by Rudy Mak Surveying Ltd.,
- Conceptual Architectural Plans (Drawing: Site Plan), prepared by We Merchandise Space Inc.
- As-recorded Plan & Profile Plans and Drainage Plans, provided by the City of Barrie,
- Engineering Standards, Policies and Guidelines, City of Barrie,
- Water Supply Master Plan Update, dated April 2019, City of Barrie,
- Fire Underwriters Survey, 1999,
- LSRCA Technical Guidelines for Stormwater Management Submissions, Lake Simcoe Region Conservation Authority

2.0 WATER SUPPLY

2.1 Existing Water Supply

There is an existing 150mm ø watermain running along Loon Avenue to the north of the site that transitions to a 200mm ø watermain before connecting into an existing 300mm ø watermain on Huronia Road to the west. The adjacent proposed 521 Huronia Road development on the west of the subject site proposed to connect to the existing 300mm ø watermain plug on Huronia Road and the adjacent development proposes a looped connection to Loon Avenue through the northwest corner of the subject site. Water servicing for the proposed development will loop internally and connect in two locations to the watermain proposed as part of the 521 Huronia Road development. Existing and external land's watermain infrastructure are shown on **Figure 3 – Water Servicing Plan**.

Hydrant flow testing records from 2020 were provided by Vipond Inc. and have been used to evaluate the theoretical fire flow available for the site. Refer to **Appendix A** for the hydrant flow test.

2.2 Proposed Water Supply

The proposed development will be serviced through a connection to the existing 150mm ø watermain on Loon Avenue and connection to the proposed watermain in the northwest corner of the site provided by the development of the adjacent 521 Huronia Road lands. The watermain through 521 Huronia Avenue connects into the existing 300mm ø watermain on Huronia Road. A 200mm ø watermain network is proposed internally to service the site.

The townhouse units shall each have an individual service connection to the proposed watermain as per the City of Barrie standard drawings. Municipal metering for townhomes shall be determined during detailed design. Hydrants shall be proposed on the site to provide

adequate fire protection coverage. Refer to **Figure 4** – Water Servicing Plan for the proposed watermain layout.

The City of Barrie's Water Transmission and Distribution Policies and Design Guidelines states that governing flows shall be determined by the maximum day demand plus fire flow. An average daily demand of 225 L/cap/day was used and factors of 2.75 and 4.13 were applied to calculate the residential maximum day and maximum hour demand as specified by the City of Barrie and the MECP. Refer to **Appendix A** for the supporting calculations of the proposed flows. The calculated daily demands for the proposed development are as follows:

Residential:

- Average Day Demand = 42 L/min
- Maximum Hour Demand = 174 L/min
- Maximum Day Demand = 116 L/min

The Fire Underwriter's Survey (FUS) guidelines were used to calculate the fire flow requirements of the residential site. The proposed stacked townhouse blocks are to have fire rated separation as required by the OBC. As the architectural details for the units are yet to be detailed, fire breaks have been assumed to achieve the required maximum GFA of 600m^2 between proposed fire breaks. It is currently assumed that the townhouses will not be sprinklered. Calculations have been conservatively assumed for the purposes of evaluating fire flow demand and can be further refined in future submissions when more information is available. Therefore, the size of the proposed watermain may be reduced in subsequent submissions. The calculations for water demand and fire flow are summarized in **Table 2.2** below which have been used for the watermain analysis for the site, which shall be further discussed later. Refer to **Appendix A** for the water and fire flow demand calculations.

Table 2.2 – Proposed Conditions Water and Fire Flow Demand Results

Block Number	Maximum Day Demand (L/s)	Maximum Hour Demand (L/s)	Fire Flow Demand (L/s)	Maximum Day + Fire Flow Demand (L/s)
Block 1	0.221	0.332	150.0	150.221
Block 2	0.294	0.442	166.7	166.961
Block 3	0.294	0.442	166.7	166.961
Block 4	0.147	0.221	133.3	133.481
Block 5	0.147	0.221	150.0	150.147
Block 6	0.147	0.221	150.0	150.147
Block 7	0.184	0.276	150.0	150.184
Block 8	0.055	0.083	116.7	116.722
Block 9	0.129	0.193	133.3	133.462
Block 10	0.037	0.055	116.7	116.703
Block 11	0.092	0.138	166.7	166.759
Block 12	0.055	0.083	116.7	116.722
Block 13	0.129	0.193	100.0	100.129

The City of Barrie's design criteria dictate the following system pressure requirements:

- Maximum pressure during the minimum hourly demand = 700 kPa (100 psi)
- Minimum pressure during maximum hour demand = 275 kPa (40 psi)
- Minimum Fire Flow pressure during simultaneous maximum day demand plus fire flow = 140 kPa (20 psi).

A watermain model has been prepared to analyze the proposed development watermain network to determine if the existing infrastructure has adequate pressure and flow to service the site in all applicable conditions. The results are summarized in Section 2.3 below.

2.3 Watermain Modeling

Hydrant flow testing and modeling using EPANET has been performed to evaluate the capacity and available pressures in the existing watermain infrastructure to service the proposed watermain network. The model was prepared with two connections to the existing surrounding watermain infrastructure as describe above – one at Huronia Road (connected via a proposed stub provided by the adjacent 521 Huronia Road development) and one at Loon Avenue.

The hydrant flow tests results were used to establish the boundary conditions. A hydrant test was taken at hydrant on Huronia Road and at a hydrant on Loon Ave to establish the respective boundary conditions that were used to generate flow curves that were inputted into the model. Refer to **Appendix A** for the hydrant flow test results.

The model was run based on the maximum daily demand, peak hour demand and simultaneous maximum day plus fire flow demand for proposed conditions. The maximum day plus fire flow conditions have been run at the most critical blocks observed in the development based on the location of the block within the site as well as the total fire demand. Multiple scenarios were analyzed for fire flow to ensure the entire development can be serviced with the existing network. In addition, the adjacent 521 Huronia Road development has been included in the EPANET model watermain analysis. The respective demands at each scenario have been inputted into the model. Selected critical blocks within the adjacent 521 Huronia Road development have also been analyzed for fire flow conditions to ensure the entire system can be serviced with the surrounding infrastructure.

The results of the most critical pressures of the water distribution modeling are summarized in **Tables 2.3.1** and **2.3.2** below.

Table 2.3.1 – Proposed Conditions Residual Pressures During Non-Fire Flow Scenarios

Scenario	Lowest Pressure			Satisfies Pressure Requirements?
	Pressure (m H_2O)	Pressure (psi)	Pressure (kPa)	
Max. Day	51.93	73.84	509.13	Yes
Peak Hour	51.91	73.81	508.93	Yes

Table 2.3.2 – Proposed Conditions Residual Pressures During Fire Flow Scenarios

Fire Flow Location	Max. Day + Fire Flow requirements (L/s)	Max. Velocity (m/s)	Lowest Pressure			Satisfies Fire Flow Requirements?
			Pressure (m H_2O)	Pressure (psi)	Pressure (kPa)	
Block 2 / J20	166.961	4.03	39.54	56.22	387.66	Yes
Block 7 / J26	150.184	4.78	36.39	51.75	356.77	Yes
Block 8 / J28	116.722	3.72	41.52	59.04	407.07	Yes
Block 9 / J26	133.462	4.26	43.57	61.96	427.17	Yes
Block 11 / J30	166.759	3.13	41.79	59.42	409.71	Yes
EXT - Huronia Block 5 / J6	150.302	3.23	47.12	67.00	461.97	Yes
EXT - Huronia Block 6 / J9	100.101	1.87	51.18	72.78	501.78	Yes

Refer to **Appendix A** for the calculation details and full model outputs. The hydrant flow test and modelling results demonstrate that available flow in the municipal watermain will satisfy the water demand of the proposed development.

Based on the watermain analysis prepared, the proposed watermain system will have adequate flow and pressure to service the proposed development under all applicable conditions

including max day, peak hour, and max day + fire flow. The proposed water distribution system for the development shall adequately provide max day + fire flow demand while maintaining a residual pressure of over 140 kPa, as per the Fire Underwriter's Survey. Therefore, no external upgrades or retrofits are anticipated for the existing surrounding watermain network to service the proposed development.

3.0 SANITARY SERVICING

3.1 Existing Sanitary Servicing

There is an existing 250mm ø sanitary sewer on Loon Avenue beginning at a manhole located on the intersection at Huronia Road and drains from west to east. There is an existing manhole located approximately 180m east-northeast of the site on the adjacent City owned property with a west invert of 236.21. The site does not currently have any available sanitary sewer connection nor any available local sewer along the frontage.

3.2 Proposed Sanitary Servicing

The site will be serviced by an existing sanitary manhole located northeast of the site on the adjacent property. Refer to **Figure 4** – Sanitary Servicing Plan for the proposed sanitary sewer layout.

Contributing sanitary flows from the proposed development are calculated based on the City of Barrie's sanitary guidelines. The proposed peak design flow from the subject site to the existing 250mm sanitary system is **2.82 L/s**. Based on review of the available sanitary design sheet for the subdivision, the local sewers downstream to the Lover's Creek Trunk sewer have adequate capacity to accommodate the subject site. Refer to **Appendix B** for supporting sanitary calculations. A downstream sanitary capacity analysis has been performed to assess the capacity of the existing downstream sewers and the results are discussed in **Section 3.3** below.

When modeled under ultimate conditions, the downstream sanitary sewers record no surcharging conditions up to the Lovers Creek trunk sewer.

3.3 Downstream Sanitary Analysis

A downstream sanitary analysis was prepared for the proposed development to assess the sanitary capacity of the downstream sewers along Loon Avenue and the downstream sanitary easement. The analysis considers the upstream contributing sanitary drainage areas down to the trunk sewer. Existing drainage plans, infrastructure maps and as-built drawing information was received from the City and were used to construct the sanitary design sheet analysis. The existing drainage plans and latest existing sanitary design sheet has been included in **Appendix D**. It has been assumed that the approved drawings and drainage plans received contain accurate information to be used for the analysis. Current development applications needed to be added to the design sheet to reflect the current existing conditions. One current development application has been identified upstream of the subject site that contributes to the downstream sanitary sewers, which has been mentioned previously and is referred to as 521 Huronia Road. This development has been included and identified in the overall sanitary design sheet included in **Appendix D**.

Based on the re-created existing sanitary design sheet, with the current development application added in, the total flow contributing to the trunk sewer from the contributing sanitary sewers is **30.17 L/s**. This flow results in the last sanitary sewer leg downstream to be at **68%** full. In the proposed conditions, the total contributing flow result is **32.99 l/s**. This results in an increase in sanitary flow of **2.82 L/s** and increases the sanitary operating capacity to **73%** full. There is a small increase in sanitary flows resulting from the proposed development and based on the analysis, there is no surcharging anticipated in the existing downstream sanitary sewers. The peak flow to flow full ratio is just above the City of Barrie criteria that requires upsizing once 70% flow full capacity is reached. However, upsizing is not recommended for the following reasons;

- The last leg of sewer prior to connecting to the Lovers Creek trunk sewer is a creek crossing. Upsizing would result in high cost compared with the benefit,

- the drainage area appears to be developed close to its full potential with the development proposal of the subject site and the adjacent 521 Huronia Avenue lands,
- the actual flows are typically much less than theoretical flows,
- and the downstream length of sewer are several hundred meters downstream of the nearest basement connection.

Therefore, the existing sanitary sewers have adequate capacity to service the proposed development. Refer to calculations in **Appendix D**.

4.0 STORMWATER SERVICING

4.1 Existing Stormwater Drainage

There is currently no storm servicing infrastructure in the vicinity of the subject site. The nearest storm system consists of an existing 450mm ø storm sewer on Loon Avenue flowing west to east that drains into an existing 750mm ø storm sewer downstream. The site is currently comprised of forest cover and wetland and stormwater flows generally sheet drain from northwest to southeast, toward the wetland feature located along the south boundary of the developable area.

The existing site is considered as a single drainage area (Refer to **Figure SWM-1** – Pre-Development Drainage Areas). The existing drainage areas are summarized in **Table 4.1** below**.**

Based on a run-off coefficient of 0.20 and the City of Barrie's specified IDF curves, the pre-development existing site characteristics are as follows:

Table 4.1 – Pre-Development Drainage Areas

Area ID	Area (ha)	Runoff Coefficient
101	2.56	0.20

4.2 Allowable Release Rate

As per the City of Barrie and LSRCA design criteria the site will control peak runoff flows from the 2-year to the 100-year storm event under post-development conditions to the corresponding pre-development release rate or less.

The allowable discharge from the subject site is calculated as follows: **Q_A = C x A x i (L/s)**

Table 4.2: Allowable Release Rates

Storm Event	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Pre-development Release Rates (L/s)	118	155	180	232	281	321

Refer to **Appendix C** for allowable release rate calculations.

4.3 Proposed Stormwater Servicing

The proposed residential development will be serviced through surface conveyance and a minor storm sewer system. Stormwater flows will be directed south towards the existing wetland. The stormwater outlet for the site will require discharge to the existing wetland areas near the southeast corner of the site.

On-site stormwater flows will be conveyed along the private road and collected by a private storm sewer system and directed towards the storage chamber located on the southeast of the site. The level spreader downstream of the storm filter outlet shall allow for safe conveyance of the discharged stormwater to the wetland and will mitigate the potential erosion.

Area 201 will be directed towards a green storm storage tank and controlled via an outlet structure prior to discharge from the site. Flows will be treated for quality and phosphorus via a Stormfilter unit. The remaining 1.19 ha of the site shall remain uncontrolled due to grading constraints which will consist of landscape areas and some rooftop areas. The uncontrolled

landscape and rooftop section, Area 202 located around the perimeter of the developed site will sheet flow into the adjacent wetland. The grading of the parkette area will not permit drainage from the parkette to be treated by the stormwater management system. As a result this report recommends that the pathways and ground cover in the vicinity of the amenities area be pervious surface and thereby drain uncontrolled toward the proposed EP lands to the south. Refer to **Figure SWM-2 – Post-Development Drainage Plan**.

A conveyance swale is proposed along the north property line to collect external drainage from the rear yards of existing single-family dwellings that front Loon Avenue.

Refer to **Figure 5 – Stormwater Servicing** for the proposed stormwater servicing strategy.

4.4 Proposed Stormwater Management

4.4.1 Quantity Control

As mentioned above, the 2 to the 100-year post-development peak run-off rates will be controlled to the corresponding 2 to 100-year pre-development peak run-off rates. Under post-development conditions, for the purposes of this report, the controlled portion of the site will be represented as a single drainage area that will be controlled to the required release rates. During detailed design, the site may be divided further into separate drainage areas, for example, according to the drainage to each LID feature. The site shall be shown as one drainage area for clarity and simplicity in the calculations for the current application submission. Refer to **Figure SWM-2** for the post-development drainage plan. **Table 4.4** below summarizes the proposed peak flows for each storm event and associated storage requirements for the proposed development. The storage provided is based on the footprint of the largest primary LID / storage feature for the site. The small LID features on-site have been excluded for storage as a conservative approach.

Table 4.4 – Post-Development Peak Flow and Storage Summary – Area 201

Storm Event	Allowable Release Rate (L/s)	Storage Required (m^3)	Storage Provided (m^3)	Total Site Release Rate (L/s)
2-Year	34	181	N/A	34
5-Year	45	243	N/A	45
10-Year	52	285	N/A	52
25-Year	70	343	N/A	70
50-Year	92	351	N/A	92
100-Year	110	370	N/A	110

The proposed site release rate during the 100-year storm event will be controlled to the maximum allowable release rate of 110 L/s. This results in **370m^3** of required storage within the site. The required storage will be provided by the green storm module system or stormtech chamber system. The release rates shall be controlled by an outlet structure that releases storm flows overland. Based on the outlet structure, a maximum of 370m^3 of storage shall be utilized in the 100-year storm. The specific orifice control sizes can be provided at detailed design stage. Refer to **Appendix C** for storage volume calculations. The proposed storage system, top elevation can be as high as approximately 244.40m while still providing frost cover. The storm outfall invert will be 242.75m.

The release rates shall be controlled by an orifice control plate welded and bolted into the inside of the tank outlet at a low elevation, that outlet to the Storm filter unit downstream. Conceptual size for the orifice was calculated to be 120mm.The details and sizes of the orifice plates shall be confirmed during detailed design. An emergency overflow weir is proposed to be installed on the tank and drain to the flow spreader. This weir would be set at the 100-year water level and be activated in case the orifice control structures were to block. In addition, an emergency overflow hatch will be provided on the tank for maintenance and to allow for overflow of stormwater. Refer to **Appendix C** for storage volume calculations.

Emergency flows exceeding the conveyance capacity of the proposed swales and storage features will be directed overland towards the existing wetland. Refer to **Appendix C for storage volume calculations.**

4.4.2 Quality Control

4.4.2.1 Total Suspended Solids

The proposed development shall target an enhanced level of quality control (80% Total Suspended Solids removal) for the site. Quality control will be provided by the proposed Stormfilter cartridge system that is equipped with PhosphoSorb media that shall provide the necessary stormwater treatment, including 80% TSS, phosphorus, oil, grease, and heavy metal pollutant removal. The stormwater tank will outlet to the proposed level spreader towards the existing wetland. In addition to this all collected stormwater will drain towards a long Stormtech Isolator row system for the majority of the stormwater conveyance system. This Isolator row will provide an additional 80% TSS removal and act as pre-treatment for the Stormfilter to increase the longevity and the filter cartridges and reduce overall needed maintenance. The Isolator row has been shown to provide 80% TSS removal as per ETV testing which is included in Appendix C. The Stormtech system will be lined where the bottom elevation is less than 1m from the high water table.

4.4.2.2 Phosphorus control

The proposed development shall make efforts to control post-development phosphorus loading to pre-development levels as per LSRCA standards. The development shall adhere to the Lake Simcoe Protection Plan Policy 4.8DP and LSRCA's Phosphorus Offsetting Policy. A phosphorus calculation has been prepared to determine the pre- and post-development phosphorus loading from the site. The pre-development conditions of the site have been considered as a forest land use, which has a phosphorus coefficient of 0.06 kg/ha. Given the 2.56ha site, the resulting phosphorus loading was 0.150 kg/yr.

Under proposed conditions, the site is comprised of high intensity residential development for the purposes of the phosphorus loading calculation. The resulting phosphorus loading under post-development conditions without mitigation is 2.85 kg/yr. With the treatment mitigation provided by the Stormfilter system with Phosphosorb media, which is expected to treat at least 79% of the phosphorus concentration as per ETV Testing Results included in **Appendix C**. In

addition to this downstream vegetation from the outlet and for uncontrolled areas acts as a natural vegetative filter strip prior to stormwater entering the wetland. The vegetative filter strip provides 65% phosphorus removal, the Phosphosorb media plus the vegetative filter strip provide a treatment train approach with an overall removal of 93% (conservatively coded in as 86% on the phosphorus loading tool). The resulting phosphorus loading is 0.82 kg/yr. 2.56 kg/yr of phosphorus is removed which is approximately 80% phosphorus removal. As per the LSRCA's Lake Simcoe Phosphorus Offsetting Policy, a cash-in-lieu is proposed for the development based on the net pre- and post-development phosphorus loading. The net increase in phosphorus loading for the proposed site is 0.82 – 0.15 = 0.67 kg/yr. Refer to **Appendix C** for the phosphorus loading calculations. Therefore, the cash-in-lieu calculation is as follows:

0.67 kg/yr x 2.5 offset ratio x $35,000 kg/yr = $58525

Administration Fee = $56,000 x 15% = $8,793.75

Total Cost = $56,000 + $8,400 = **$67,418.75**

It is noted that the Stormtech Isolator Row likely does provide some phosphorus removal but has conservatively not been accounted for. This is based upon the assumption that phosphorus binds to TSS and some of it would have been removed via settling within the Stormtech Isolator rows.

4.4.2.3 Winter Salt

The proposed site is a relatively small townhouse condo development, with low traffic and salt pollution risk. In addition, all controlled stormwater flows shall be treated by the proposed Stormfilter Cartridge system with Phosphosorb media. Based on documentation regarding the Stormfilter cartridges, the system is able to provide treatment for pollutants such as soluble metals and nutrients as well, therefore, some salt shall also be removed from the runoff prior to discharge to the wetland, further reducing concern for salt pollution. Refer to **Appendix C** for documentation and specifications on the Stormfilter Cartridge System.

4.4.2.4 Temperature

The proposed development shall consist of underground storm infrastructure to convey captured drainage. All flows will be conveyed in the piping towards the treatment system, reducing the exposure of the runoff to heat. The underground conveyance will also contribute to cooling the runoff if temperature increased during overland drainage of the stormwater. Shading of the level spreader area with plantings such as shrubs can be implemented at the detailed design stage to further mitigate potential temperature increase in runoff.

4.4.2.5 Other Contaminants

The stormwater shall be treated by the proposed Stormfilter Cartridge system, as stated previously, which can provide treatment for oil, grease and gas pollutants.

Similarly, heavy metals can also be treated by the Stormfitler Cartridge system, as indicated in the documentation for the Stormfilter system. Refer to **Appendix C** for documentation and specifications on the Stormfilter Cartridge System. Heavy metals are also recognized to adsorb to suspended sediment particles in runoff and therefore, are also removed when treating the TSS. Therefore, the system shall provide treatment for these pollutants. Regular inspection and maintenance of the Stormfilter Cartridge system is required to ensure ongoing removal of accumulated sediment and maintain optimal function of the treatment system.

It is also notable that the site shall be a relatively low traffic area and poses low risk of contaminants being discharged from the site.

4.4.3 Water Balance

The proposed development water balance shall take a best-efforts approach given the site constraints. Due to the presence of high groundwater and the compact physical layout of buildings and servicing, infiltration is not feasible anywhere on the site. Refer to **Appendix D** for excerpts from the Hydrogeological Assessment prepared by Grounded Engineering Inc. Therefore, the proposed water balance will be limited to the natural infiltration that will occur in the pervious areas, rooftop disconnection to landscape areas draining to the frontage and natural evapotranspiration throughout the site. An annual water balance calculation has been prepared by Grounded Engineering Inc. for the proposed site development to determine the water balance deficit. Under pre-development conditions, it was calculated that there will be **3,203 m^3/year** of infiltration, while the post-development conditions indicate an infiltration of **1,515 m^3/year**. This results in an anticipated water balance deficit of **1,688 m^3/year**. Excerpts from the Hydrogeological Assessment relating to water balance have also been included in **Appendix D**. Water balance will be met via cash in lieu as per the LSRCA Water Balance Offsetting Fee, which will provide the implementation of programs to make up the difference. Based on the fee schedule, the calculation is as follows:

1688 m^3/year x \$44.97 costs/m^3 = \$75,909.36;
Administration Fee = 15% x 75,909.36 = \$11,386.40
Total Fee = \$75,909.36 + \$11,386.40 = **\$87,295.76**

The volume control target is on-site treatment / filtration of 25mm from all impervious area for the site. For the subject site there is approximately 7000m^2 of impervious area (asphalt and side walks) and approximately 6,500m^2 of building area (areas rounded up to the nearest 500 m^2 for the purposes of functional design). The 25mm volume control target for 13,500 m^2 is to retain or treat the first 337.5 m^3 from each storm event.

For constrained sites, options for volume control include: 25mm volume control target as well as alternative #1 for 12.5mm on-site retention, and Alternative #2 for minimum 5mm on-site

retention. Various LID efforts have been explored in the design, but due to the site constraints, they have been deemed unfeasible for the development.

The primary constraints applicable to the proposed development for further on-site retention are:

- High Groundwater Table
- Property, Spatial and Infrastructure restrictions

The layout of the townhouse community development is compact and guided by the developable area adjacent to the wetland. The dwellings, road and proposed servicing trenches limit the available space for infiltration measures.

The groundwater table has been reviewed and it has been determined that the groundwater level is close to the surface due to proximity to the existing wetland. Refer to the Hydrogeological Assessment prepared by Grounded Engineering Inc. for further details.

Where infiltration measures are not feasible, filtration treatment is accepted as a secondary method for meeting volume control. The volume of filtration treatment must matches the at minimum the 5 mm depth over all proposed impervious areas of the site with the intent to treat as much as possible up to the 25mm target. The minimum 5mm target volume for filtration is 67.5 m^3.

It is proposed to implement Stormtech Isolator rows throughout the entirety of the stormwater conveyance system layout as shown on **Figure No 5**. Subject to ongoing groundwater monitoring, these system will be lined with an impermeable liner where separation from the groundwater is less than 1.0m. The Stormtech Isolator row will be sized for at least 370 m^3 of total storage per the quantity control requirements. The isolator row can be sized to ensure a minimum volume of 67.5 m^3 will be treated via filtration before stormwater will flow to the main storm system for conveyance and ultimately to the Stormfilter and outlet to the vegetated filter strip. The Stormtech Isolator rows have 80% TSS removal capabilities as per ETV testing.

Subject to final high groundwater levels, infiltration may be possible in areas of significant engineered fill where the bottom of storm filter tank can be shown 1m above the high ground water table. Furthermore, the downstream vegetation from the outlet of the site acts as a natural filter strip that aids with providing this alternative method to meeting the volume control requirements. The parkette is contemplated to be constructed with impervious ground cover materials. Thus, all impervious areas are being treated by an LID method to aid in volume control.

5.0 SITE GRADING

The site will be graded in accordance with the City of Barrie standards, requirements under the Accessibility for Ontarians with Disabilities Act (AODA) and building design. The grading design will respect the existing overland drainage patterns. This will minimize disturbance to the existing site and surrounding land. It is not anticipated that grading will be required within any of the environmental setbacks. Refer to **Figure 6** – Conceptual Grading Plan.

6.0 FUTURE DEVELOPMENT

Currently, it is anticipated that the adjacent lands to the west, known as the 521 Huronia Road development shall occur, however the phasing/timeline of the development is currently uncertain. It is possible that these external lands shall be developed prior to or in conjunction with the proposed development. This shall be a residential townhome development that proposes an access from Huronia Road and shall also drain towards the existing wetland.

As mentioned previously, the adjacent proposed 521 Huronia Road development shall provide a watermain servicing stub to service the subject site and therefore is co-dependent with the proposed development of these lands. Further provisions can be explored between the adjacent development and the subject site if required. If the properties are developed together, there is an opportunity to convey sanitary flows from the 521 Huronia through the Loon Avenue Lands to the downstream sanitary sewer. The benefit of this arrangement would be less sanitary sewer required to service the two properties and adding the sanitary flows from the two developments at the furthest possible downstream location.

7.0 CONCLUSIONS

Based on the assessment provided above, the existing adjacent infrastructure can accommodate the proposed change in lands use as follows:

WATER SERVICING:

There is an existing 150mm ø watermain running along Loon Avenue to the north of the site that transitions to a 200mm ø watermain before connecting into an existing 300mm ø watermain on Huronia Road to the west. The adjacent proposed 521 Huronia Road development on the west of the subject site proposed to connect to the existing 300mm ø watermain plug on Huronia Road and the adjacent development proposes a looped connection to Loon Avenue through the northwest corner of the subject site. Water servicing for the proposed development will loop internally and connect in two locations to the watermain proposed as part of the 521 Huronia Road development.

The proposed development will be serviced through a connection to the existing 150mm ø watermain on Loon Avenue and connection to the proposed watermain in the northwest corner of the site provided by the development of the adjacent 521 Huronia Road lands. The watermain through 521 Huronia Avenue connects into the existing 300mm ø watermain on Huronia Road. A 200mm ø watermain network is proposed internally to service the site. Based on the watermain analysis prepared, the proposed watermain system will have adequate flow and pressure to service the proposed development under all applicable conditions including max day, peak hour, and max day + fire flow. The proposed water distribution system for the development shall adequately provide max day + fire flow demand while maintaining a residual pressure of over 140 kPa, as per the Fire Underwriter's Survey. Therefore, no external upgrades or retrofits are anticipated for the existing surrounding watermain network to service the proposed development.

SANITARY SERVICING:

There is an existing 250mm ø sanitary sewer on Loon Avenue beginning at a manhole located on the intersection at Huronia Road and drains from west to east. There is an existing manhole located approximately 180m east-northeast of the site on the adjacent City owned property with a west invert of 236.21. The site does not currently have any available sanitary sewer connection nor any available local sewer along the frontage.

The site will be serviced by an existing sanitary manhole located approximately 150m east-northeast of the site on the adjacent City owned property. The invert of the manhole is 236.21. The proposed peak design flow from the subject site to the existing 250mm sanitary system is **2.82 L/s**. Based on review of the available sanitary design sheet for the subdivision, the local sewers downstream to the Lover's Creek Trunk sewer have adequate capacity to accommodate the subject site.

STORMWATER SERVICING:

There is currently no storm servicing infrastructure in the vicinity of the subject site. The nearest storm system consists of an existing 450mm ø storm sewer on Loon Avenue flowing west to east that drains into an existing 750mm ø storm sewer downstream. The proposed residential development will be serviced through surface conveyance and a minor storm sewer system. Stormwater flows will be directed south towards the existing wetland.

The proposed site release rate during the 100-year storm event will be controlled to the maximum allowable release rate of 110 L/s. This results in **370m3** of required storage within the site. The required storage will be provided by the green storm module system or stormtech chamber system.

Quality control will be provided by the proposed Stormfilter cartridge system that is equipped with PhosphoSorb media that shall provide the necessary stormwater treatment, including 80% TSS, phosphorus, oil, grease, and heavy metal pollutant removal. The Phosphosorb will provide 79% phosphorus removal as per ETV testing results.

The resulting phosphorus offsetting cost is as follows:

0.67 kg/yr x 2.5 offset ratio x $35,000 kg/yr = $58,625
Total Cost = $67,418.75

Volume control will be provided by the stormtech chamber isolator row meeting a minimum filtration treatment volume of 5mm from all impervious areas. Infiltration potential from the stormtech chamber is to be explored in areas of significant engineered fill when 1.0m groundwater separation from the stormtech chambers can be achieved.

The Water Balance Offsetting Fee has been calculated assuming infiltration will not be possible and can be revisited pending confirmation of the high groundwater table. Based on the fee schedule, the calculation is as follows:

1688 m^3/year x $44.97 costs/$m^3$ = $75,909.36;
Administration Fee = 15% x 75,909.36 = $11,386.40
Total Fee = $75,909.36 + $11,386.40 = **$87,295.76**

In accordance with the offsetting policies, the greater of the Water Balance Offset Fee and the Phosphorus Offsetting Fee with be payable. For the contemplated development proposal it is expected that the Water Balance Offsetting Fee will be payable.

We trust the information provided in the report meets with your requirements. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,

Counterpoint Engineering Inc.

Karl Repka, P. Eng.
krepka@counterpointeng.com

Prince Trinidad-Rhodius, E.I.T.
ptrinidadrhodius@counterpointeng.com

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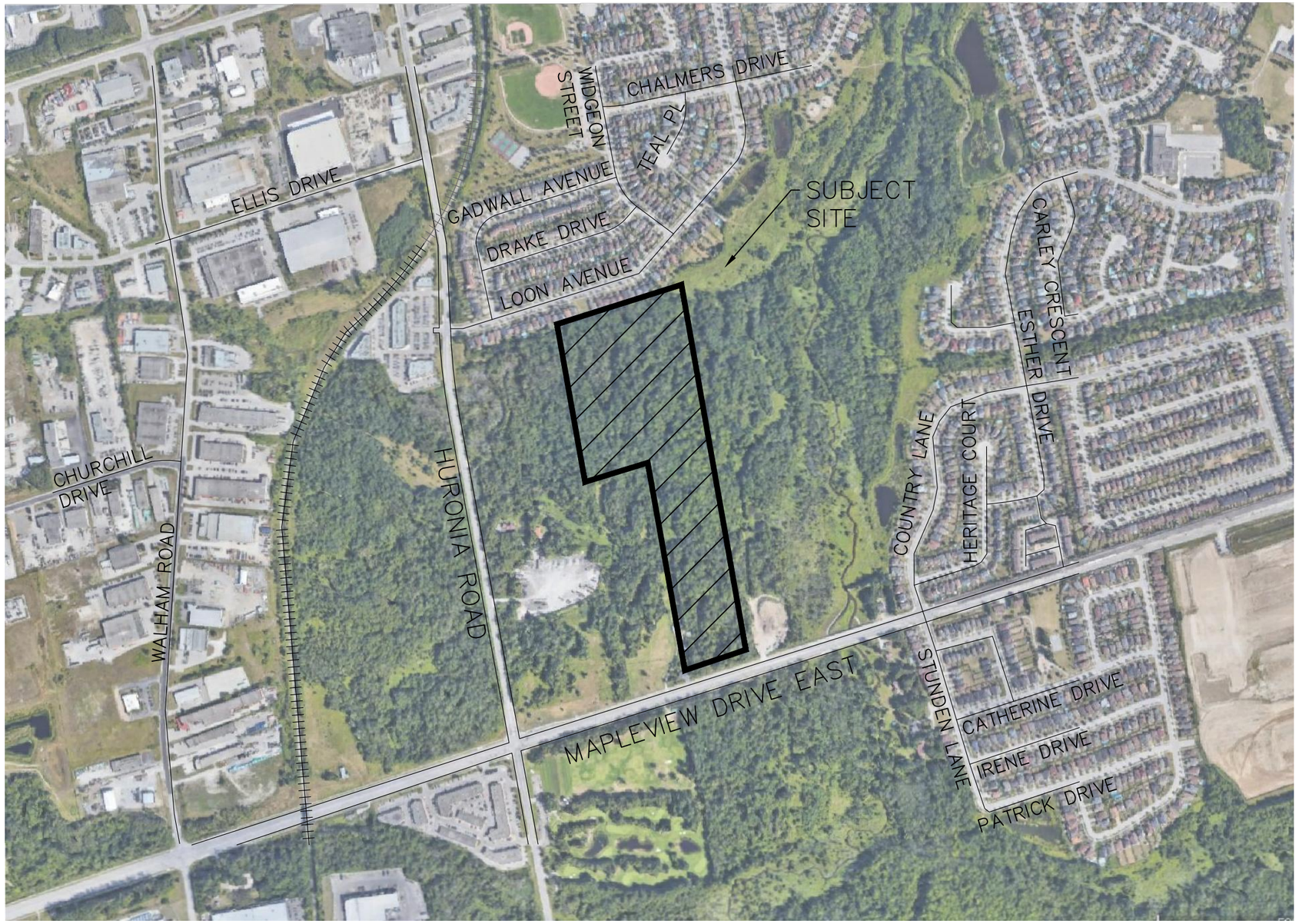
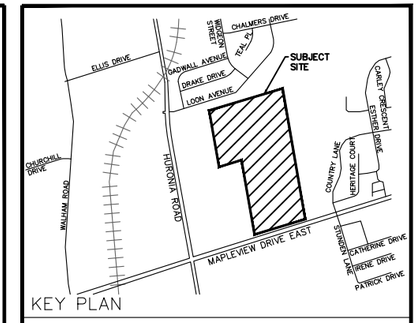
Figures





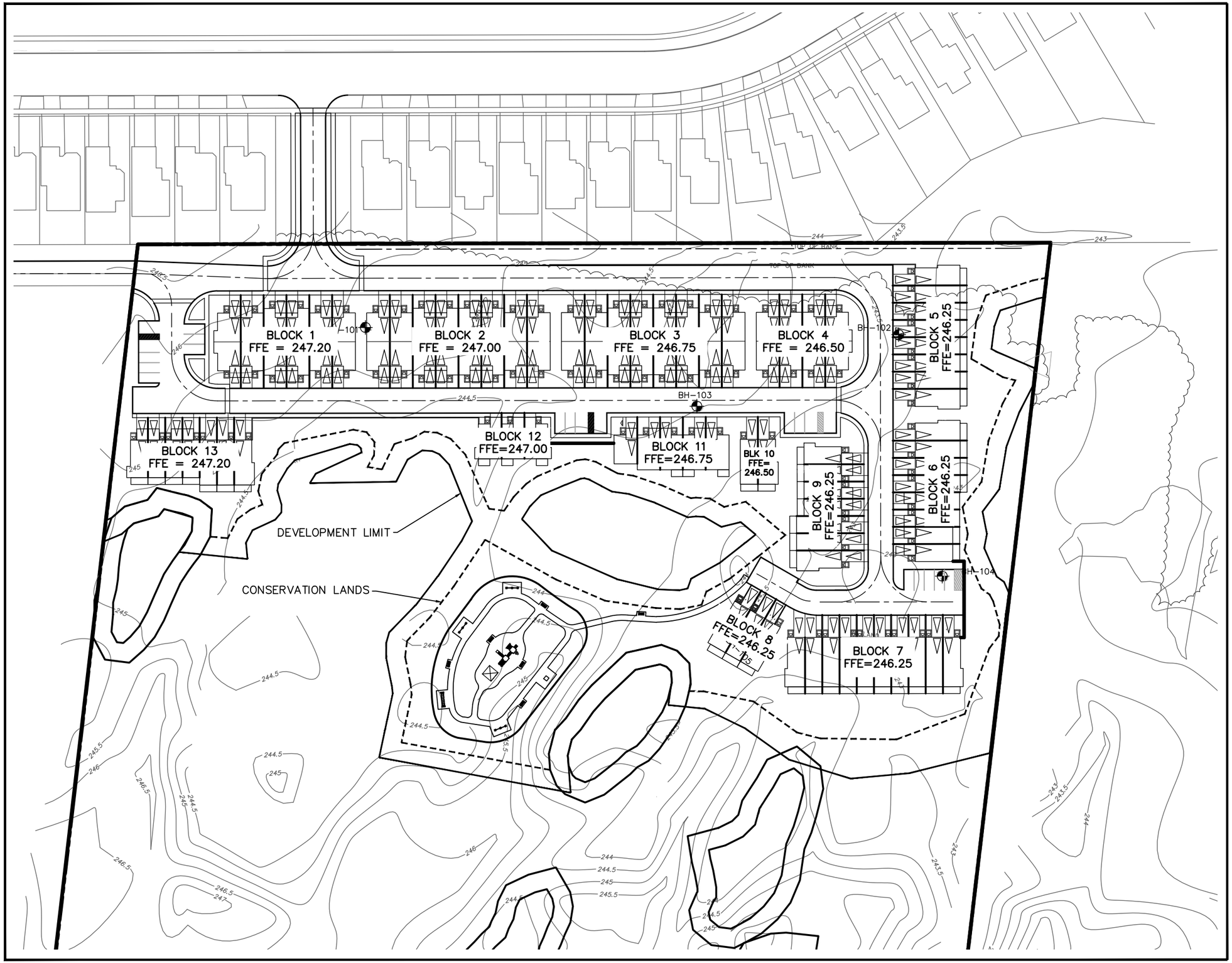
KEY PLAN

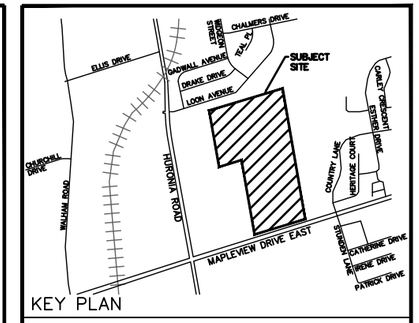
counterpoint ENGINEERING
COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

340 MAPLEVIEW DRIVE
PROPOSED TOWNHOME COMMUNITY
BARRIE, ONTARIO

SITE LOCATION PLAN

DESIGNED BY:	DATE: February 2022
CHECKED BY: KR	PROJECT No. 21076
DRAWING BY:	
CHECKED BY: KR	FIGURE No. 1
SCALE: NTS	





KEY PLAN

LEGEND

PROPERTY LINE

EDGE MANAGEMENT BUFFER

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BARRIE, ONTARIO

GENERAL PLAN

DESIGNED BY:	DATE: February 2022
CHECKED BY: KR	PROJECT No. 21076
DRAWING BY:	
CHECKED BY: KR	FIGURE No. 2
SCALE: 1:1000	

EX. 150mmø W/M

BLOCK 1
FFE = 247.20

BLOCK 2
FFE = 247.00

BLOCK 3
FFE = 246.75

BLOCK 4
FFE = 246.50

BLOCK 5
FFE=246.25

BLOCK 6
FFE=246.25

BLOCK 7
FFE=246.25

BLOCK 8
FFE=246.25

BLOCK 9
FFE=246.25

BLOCK 10
FFE=
246.50

BLOCK 11
FFE=246.75

BLOCK 12
FFE=247.00

BLOCK 13
FFE = 247.20

BH-101

BH-102

BH-103

BH-104

TOP OF BANK

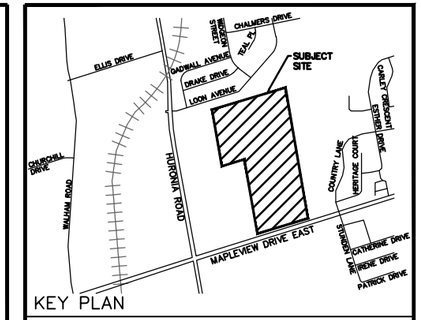
TOP OF BANK

50mm COPPER WATERMAIN

50mm COPPER WATERMAIN

DEVELOPMENT LIMIT

CONSERVATION LANDS
(5M WETLAND BUFFER)



KEY PLAN

LEGEND

PROPERTY LINE

EXISTING WATERMAIN

PROPOSED WATERMAIN

PROPOSED HYDRANT

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340 MAPLEVIEW DRIVE
PROPOSED TOWNHOME COMMUNITY
BARRIE, ONTARIO

WATER SERVICING PLAN

DESIGNED BY:	DATE: February 2022
CHECKED BY: KR	PROJECT No. 21076
DRAWING BY:	
CHECKED BY: KR	FIGURE No. 3
SCALE: 1:1000	

EX. 250mmø SAN @ 2.00%

BLOCK 1
FFE = 247.20

BLOCK 2
FFE = 247.00

BLOCK 3
FFE = 246.75

BLOCK 4
FFE = 246.50

BLOCK 5
FFE=246.25

BLOCK 6
FFE=246.25

BLOCK 7
FFE=246.25

BLOCK 8
FFE=246.25

BLOCK 9
FFE=246.25

BLOCK 10
FFE=
246.50

BLOCK 11
FFE=246.75

BLOCK 12
FFE=247.00

BLOCK 13
FFE = 247.20

BH-101

BH-102

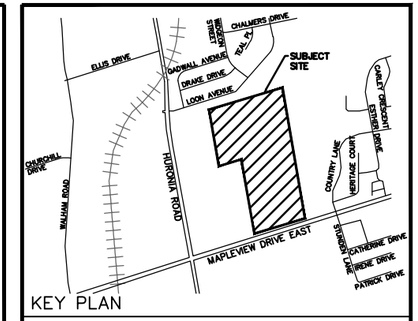
BH-103

BH-104

BH-105

DEVELOPMENT LIMIT

CONSERVATION LANDS
(5M WETLAND BUFFER)



KEY PLAN

LEGEND

- PROPERTY LINE
- EXISTING SANITARY SEWER
- EXISTING SANITARY MANHOLE
- PROPOSED SANITARY SEWER
- PROPOSED SANITARY MANHOLE

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SANITARY SERVICING PLAN

DESIGNED BY:	DATE: February 2022
CHECKED BY: KR	PROJECT No. 21076
DRAWING BY:	
CHECKED BY: KR	FIGURE No. 4
SCALE: 1:1000	

EX. 150mmø W/M

BLOCK 1
FFE = 247.20

BLOCK 2
FFE = 247.00

BLOCK 3
FFE = 246.75

BLOCK 4
FFE = 246.50

BH-101

BH-102

BH-103

BLOCK 5
FFE=246.25

BLOCK 6
FFE=246.25

BLOCK 9
FFE=246.25

BLOCK 10
FFE=
246.50

BLOCK 11
FFE=246.75

BLOCK 12
FFE=247.00

BLOCK 13
FFE = 247.20

BLOCK 7
FFE=246.25

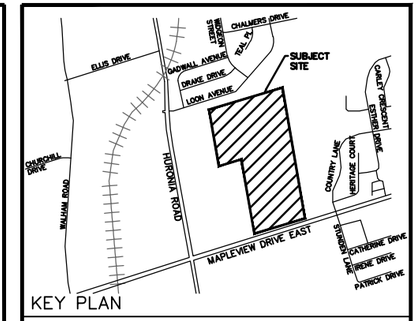
BLOCK 8
FFE=246.25

STM UNDERGROUND
STORAGE CHAMBER

STM OUTFALL
ELEV = 242.75m

DEVELOPMENT LIMIT

CONSERVATION LANDS
(5M WETLAND BUFFER)



KEY PLAN

LEGEND

- PROPERTY LINE
- EXISTING STORM SEWER
- EXISTING STORM MANHOLE
- PROPOSED SWALE
- PROPOSED STORMSEWER

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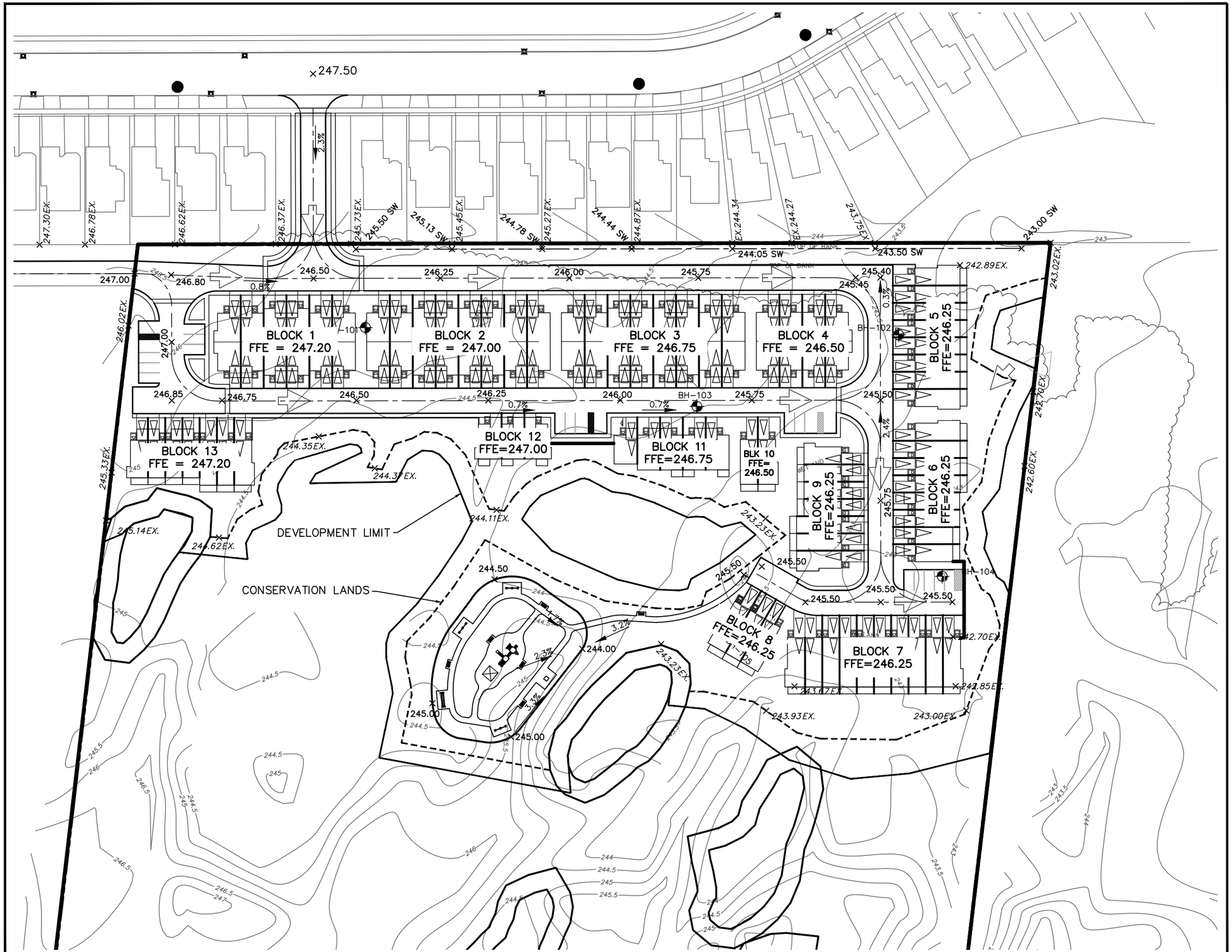
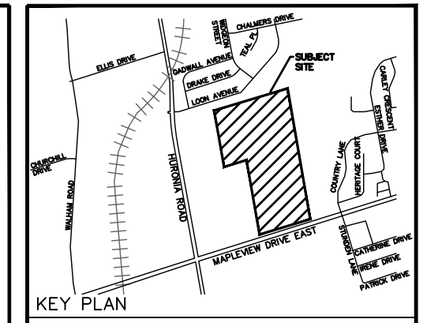
BARRIE, ONTARIO

STORM SERVICING PLAN

DESIGNED BY:	DATE: February 2022
CHECKED BY: KR	PROJECT No. 21076
DRAWING BY:	
CHECKED BY: KR	FIGURE No. 5
SCALE: 1:1000	





LEGEND

- PROPERTY LINE
- ×246.80EX. EXISTING ELEVATION
- ×246.80 PROPOSED ELEVATION
- 1.0% PROPOSED SLOPE
- OVERLAND FLOW ROUTE
- EXISTING STORM MANHOLE
- PROPOSED SWALE

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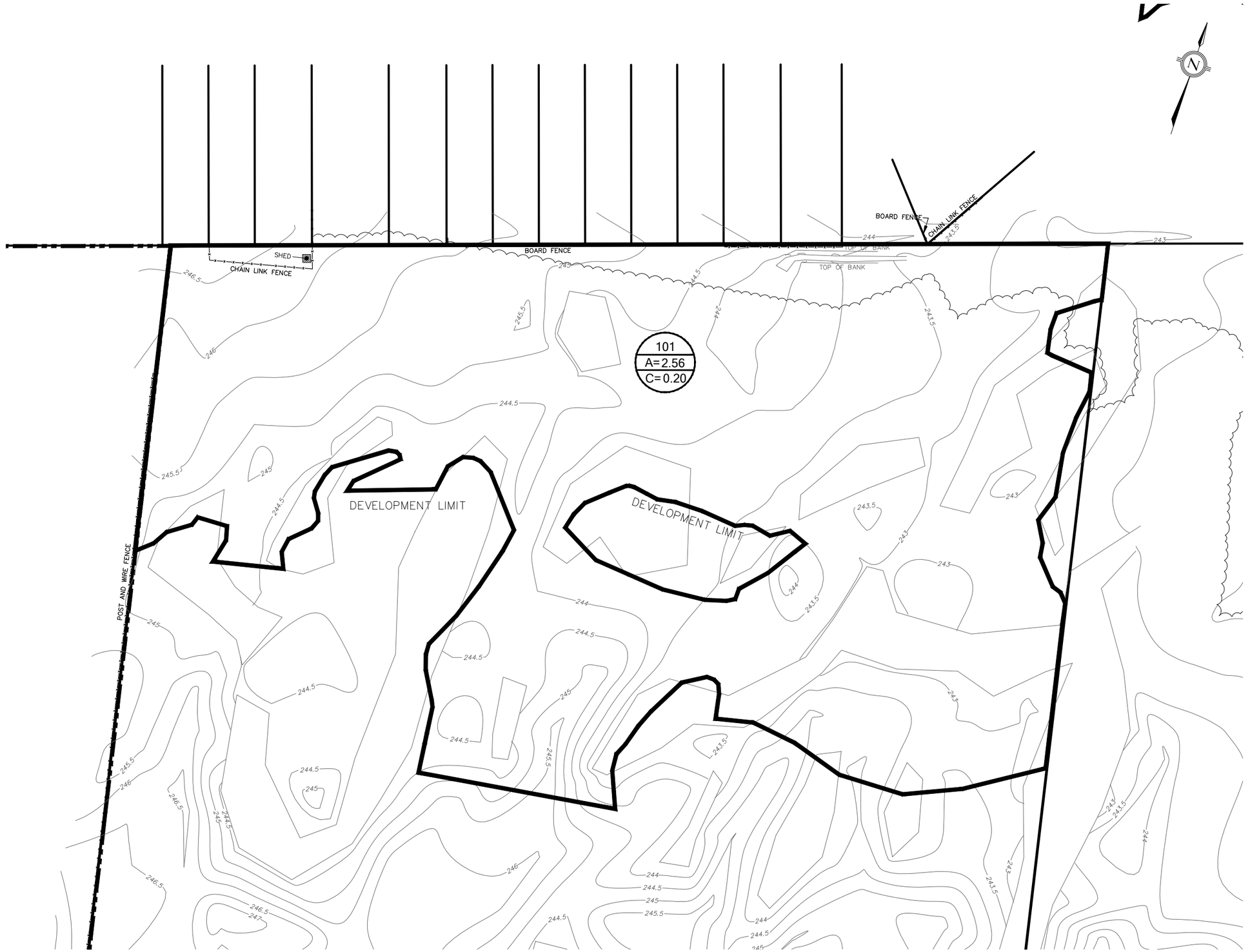
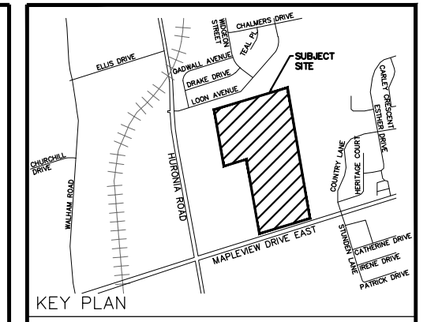
PROPOSED TOWNHOME COMMUNITY
BARRIE, ONTARIO

CONCEPTUAL GRADING PLAN

DESIGNED BY:	DATE: February 2022
CHECKED BY: KR	PROJECT No. 21076
DRAWING BY:	
CHECKED BY: KR	FIGURE No. 6
SCALE: 1:1000	





LEGEND

- DRAINAGE AREA BOUNDARY
- 101 — AREA ID
- A=1.13 — DRAINAGE AREA (HA)
- C=0.20 — RUNOFF COEFFICIENT (FOR 2–10 YEAR STORMS)
- OVERLAND FLOW PATH

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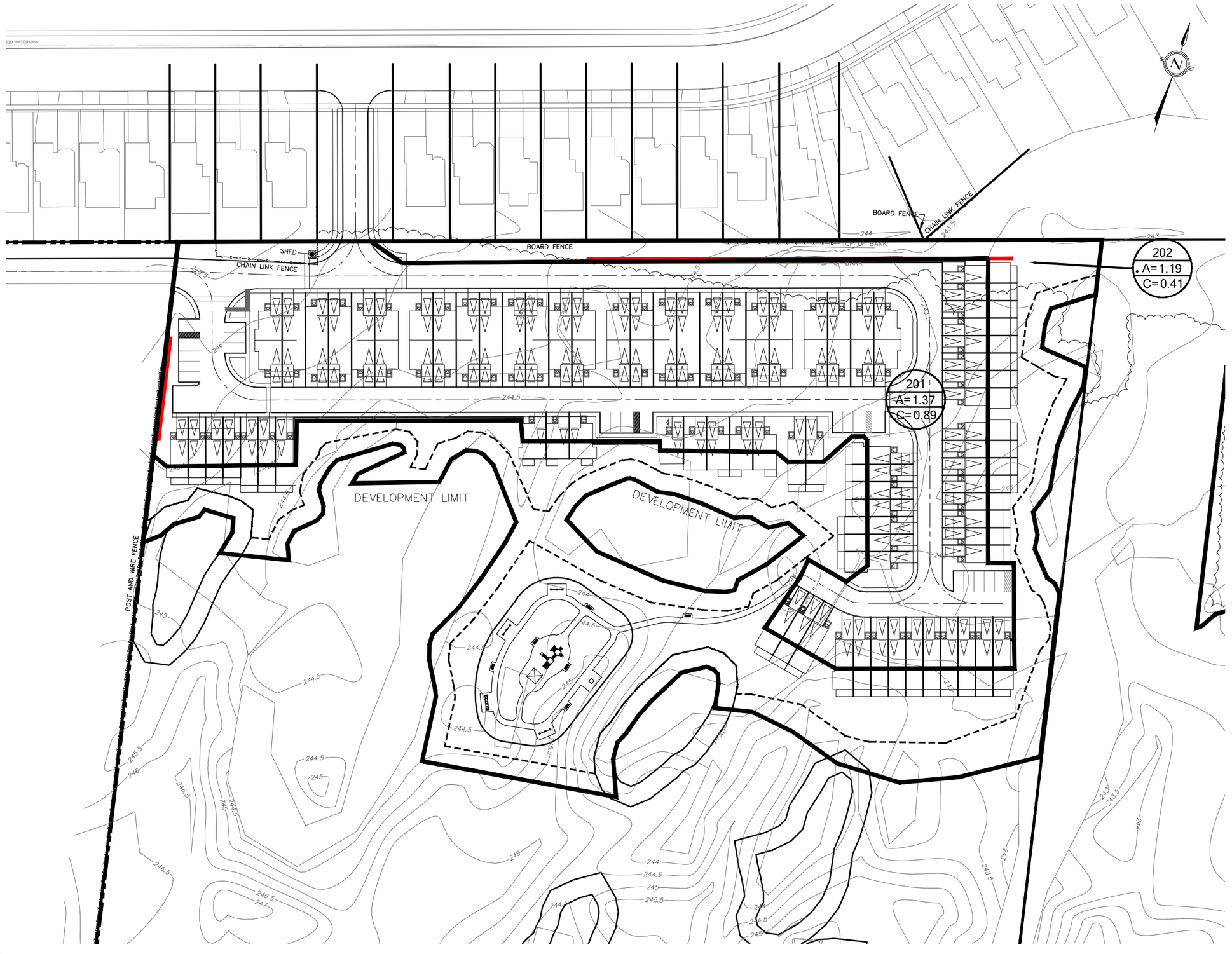
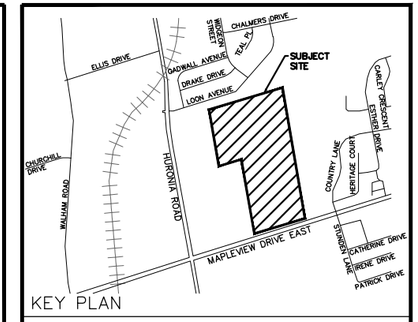
PRE-DEVELOPMENT DRAINAGE PLAN

DESIGNED BY:	DATE: February 2022
CHECKED BY: KR	PROJECT No. 21076
DRAWING BY:	
CHECKED BY: KR	FIGURE No. SWM–1
SCALE: 1:1000	





KEY PLAN

LEGEND

- DRAINAGE AREA BOUNDARY
- 101 / A=1.13 / C=0.20 — AREA ID, DRAINAGE AREA (HA), RUNOFF COEFFICIENT (FOR 2–10 YEAR STORMS)
- OVERLAND FLOW PATH

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POST-DEVELOPMENT DRAINAGE PLAN

DESIGNED BY:	DATE: February 2022
CHECKED BY: KR	PROJECT No. 21076
DRAWING BY:	
CHECKED BY: KR	FIGURE No. SWM–2
SCALE: 1:1000	

Appendix A1

Water Demand Calculations

Counterpoint Engineering Inc.

Water Demand Design Calculations

Project: **340 Mapleview Drive**
Project No: **21076**
Location: **Barrie, Ontario**
Site Area: 1.90 ha
(Area within wetland limit)

Equivalent Population per Land Use

Low Density (Single detached, etc.)	3.25	ppu
Medium Density (Townhouse, etc.)	2.57	ppu
High Density (Apartment, etc.)	1.67	ppu

	Townhouse (Units)	Commercial (m^2)	Residential Population
Block 1	12		31
Block 2	16		41
Block 3	16		41
Block 4	8		21
Block 5	8		21
Block 6	8		21
Block 7	10		26
Block 8	3		8
Block 9	7		18
Block 10	2		5
Block 11	5		13
Block 12	3		8
Block 13	7		18
TOTAL UNITS / AREA (m^2)	**105**	**-**	**270**

	Residential Population	TOTAL POPULATION
Residential	270	270
Total Equivalent Population		**270**

City of Barrie Watermain Guidelines

Per Capita Demand

Average Daily Demand	225	(L/capita/day)

Commercial Demand	28	m^3/day/ha

Peaking Factors

Land Use	Minimum Hour	Maximum Day	Maximum Hour	
Residential	0.40	2.75	4.13	(MECP factors for populations from 500 - 1000)
Commercial	0.84	2.00	1.50	(MOECP factors)
Industrial	0.84	2.00	1.50	

Proposed Site

Water Demand based on Equivalent Population

	Population	Average Daily Usage (L/min)	Maximum Hour (L/min)	Maximum Day (L/min)	Governing Fire Flow Required (L/min)	Water Demand (L/min)
Residential	270	42	174	116	10,000	10,116
Totals	**270**	**42**	**174**	**116**	**10,000**	**10,116**

Water Demand per Block based on Equivalent Population (for modeling)

	Population	Average Daily Usage (L/s)	Maximum Hour (L/s)	Maximum Day (L/s)	Fire Flow (L/s)	Maximum Day + Fire Flow (L/s)
Block 1	31	0.080	0.332	0.221	150.0	150.221
Block 2	41	0.107	0.442	0.294	166.7	166.961
Block 3	41	0.107	0.442	0.294	166.7	166.961
Block 4	21	0.054	0.221	0.147	133.3	133.481
Block 5	21	0.054	0.221	0.147	150.0	150.147
Block 6	21	0.054	0.221	0.147	150.0	150.147
Block 7	26	0.067	0.276	0.184	150.0	150.184
Block 8	8	0.020	0.083	0.055	116.7	116.722
Block 9	18	0.047	0.193	0.129	133.3	133.462
Block 10	5	0.013	0.055	0.037	116.7	116.703
Block 11	13	0.033	0.138	0.092	166.7	166.759
Block 12	8	0.020	0.083	0.055	116.7	116.722
Block 13	18	0.047	0.193	0.129	100.0	100.129

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 1
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	831 m^2
F=	6,000 **L/min** (rounded to nearest 1,000 L/min)

It is currently proposed that firewalls will be installed in between the townhouse units.

2) Occupancy Reduction/Surcharge

Contents Factor:		C		
Reduction/Surcharge of		0%	=	0 L/min
F=	6000L/min +	0	L/min =	6,000 **L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%	
Standard Water Supply:		NO	0%	
Fully Supervised:		NO	0%	
Total			0%	
Reduction of		0%	L/min =	0 L/min
F=	6000L/min -	0	L/min =	6,000 **L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	26.2	10%	
East	3	25%	
South	46	0%	(>45m)
West	25	10%	(Charge based on firewall)
Total		45%	**of** 6000 **L/min = 2,700 L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 6000L/min + 2700L/min = 8,700 **L/min** (2,000L/min<F<45,000L/min)

F=	9,000	**L/min**	(round to the nearest 1,000L/min)
F=	150	**L/s**	
F=	2,378	**gpm**	

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 2
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	831 m^2
F=	6,000 **L/min** (rounded to nearest 1,000 L/min)

It is currently proposed that firewalls will be installed in between the townhouse units.

2) Occupancy Reduction/Surcharge

Contents Factor:		C		
Reduction/Surcharge of		0%	=	0 L/min
F=	6000L/min +	0 L/min	=	6,000 **L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%	
Standard Water Supply:		NO	0%	
Fully Supervised:		NO	0%	
Total			0%	
Reduction of		0%	L/min =	0 L/min
F=	6000L/min -	0	L/min =	6,000 **L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	28	10%	
East	23	10%	(Charge based on firewall)
South	13	15%	
West	3	25%	
Total		60%	**of** 6000 **L/min** = 3,600 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 6000L/min + 3600L/min = 9,600 **L/min** (2,000L/min<F<45,000L/min)

F=	10,000	**L/min** (round to the nearest 1,000L/min)
F=	167	**L/s**
F=	2,642	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 3
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	831 m^2
F=	6,000 **L/min** (rounded to nearest 1,000 L/min)

It is currently proposed that firewalls will be installed in between the townhouse units.

2) Occupancy Reduction/Surcharge

Contents Factor:		C			
Reduction/Surcharge of		0%	=	0	L/min
F=	6000L/min +	0	L/min =	6,000	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%		
Standard Water Supply:		NO	0%		
Fully Supervised:		NO	0%		
Total			0%		
Reduction of		0%	L/min =	0	L/min
F=	6000L/min -	0	L/min =	6,000	**L/min**

4) Separation Charge

Building Face	Dist(m)	Charge			
North	27.6	10%			
East	3	25%			
South	15.6	15%			
West	25	10%	(Charge based on firewall)		
Total		60%	**of** 6000 **L/min** =	3,600	**L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 6000L/min + 3600L/min = 9,600 **L/min** (2,000L/min<F<45,000L/min)

F=	10,000	**L/min** (round to the nearest 1,000L/min)
F=	167	**L/s**
F=	2,642	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 4
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	526 m^2
F=	5,000 **L/min** (rounded to nearest 1,000 L/min)

It is currently proposed that firewalls will be installed in between the townhouse units.

2) Occupancy Reduction/Surcharge

Contents Factor:		C		
Reduction/Surcharge of		0%	=	0 L/min
F=	5000L/min +	0 L/min	=	5,000 **L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%	
Standard Water Supply:		NO	0%	
Fully Supervised:		NO	0%	
Total			0%	
Reduction of		0%	L/min =	0 L/min
F=	5000L/min -	0 L/min	=	5,000 **L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	29.8	10%	
East	25	10%	(Charge based on firewall)
South	18.5	15%	
West	3	25%	
Total		60%	**of** 5000 **L/min = 3,000 L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 5000L/min + 3000L/min = 8,000 **L/min** (2,000L/min<F<45,000L/min)

F=	8,000	**L/min** (round to the nearest 1,000L/min)
F=	133	**L/s**
F=	2,113	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 5
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	679 m^2
F=	6,000 **L/min** (rounded to nearest 1,000 L/min)

It is currently proposed that firewalls will be installed in between the townhouse units.

2) Occupancy Reduction/Surcharge

Contents Factor:		C			
Reduction/Surcharge of		0%	=	0	L/min
F=	6000L/min +	0	L/min =	6,000	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%		
Standard Water Supply:		NO	0%		
Fully Supervised:		NO	0%		
Total			0%		
Reduction of		0%	L/min =	0	L/min
F=	6000L/min -	0	L/min =	6,000	**L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	25	10%	(Charge based on firewall)
East	46	0%	(>46m)
South	3	25%	
West	16.8	15%	
Total		50%	**of** 6000 **L/min** = 3,000 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 6000L/min + 3000L/min = 9,000 **L/min** (2,000L/min<F<45,000L/min)

F=	9,000	**L/min** (round to the nearest 1,000L/min)
F=	150	**L/s**
F=	2,378	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 6
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	679 m^2
F=	6,000 **L/min** (rounded to nearest 1,000 L/min)

It is currently proposed that firewalls will be installed in between the townhouse units.

2) Occupancy Reduction/Surcharge

Contents Factor:		C		
Reduction/Surcharge of		0%	=	0 L/min
F=	6000L/min +	0 L/min	=	6,000 **L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%	
Standard Water Supply:		NO	0%	
Fully Supervised:		NO	0%	
Total			0%	
Reduction of		0%	L/min =	0 L/min
F=	6000L/min -	0 L/min	=	6,000 **L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	3	25%	
East	46	0%	(>46m)
South	25	10%	(Charge based on firewall)
West	19.7	15%	
Total		50%	**of** 6000 **L/min** = 3,000 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 6000L/min + 3000L/min = 9,000 **L/min** (2,000L/min<F<45,000L/min)

F=	9,000	**L/min**	(round to the nearest 1,000L/min)
F=	150	**L/s**	
F=	2,378	**gpm**	

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 7
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	745 m^2
F=	6,000 **L/min** (rounded to nearest 1,000 L/min)

It is currently proposed that firewalls will be installed in between the townhouse units.

2) Occupancy Reduction/Surcharge

Contents Factor:		C		
Reduction/Surcharge of		0%	=	0 L/min
F=	6000L/min +	0 L/min	=	6,000 **L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%	
Standard Water Supply:		NO	0%	
Fully Supervised:		NO	0%	
Total			0%	
Reduction of		0%	L/min =	0 L/min
F=	6000L/min -	0 L/min	=	6,000 **L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	17.8	15%	
East	25	10%	(Charge based on firewall)
South	46	0%	(>45m)
West	3	25%	
Total		50%	**of** 6000 **L/min** = 3,000 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 6000L/min + 3000L/min = 9,000 **L/min** (2,000L/min<F<45,000L/min)

F=	9,000	**L/min** (round to the nearest 1,000L/min)
F=	150	**L/s**
F=	2,378	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 8
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	580 m^2
F=	5,000 **L/min** (rounded to nearest 1,000 L/min)

2) Occupancy Reduction/Surcharge

Contents Factor:		C		
Reduction/Surcharge of		0%	=	0 L/min
F=	**5000L/min +**	**0**	**L/min =**	**5,000 L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%	
Standard Water Supply:		NO	0%	
Fully Supervised:		NO	0%	
Total			0%	
Reduction of		0%	L/min =	0 L/min
F=	**5000L/min -**	**0**	**L/min =**	**5,000 L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	15.3	15%	
East	3	25%	
South	46	0%	(>45m)
West	46	0%	(>45m)
Total		40%	**of 5000 L/min = 2,000 L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= **5000L/min +** **2000L/min** **=** 7,000 **L/min** (2,000L/min<F<45,000L/min)

F=	7,000	**L/min** (round to the nearest 1,000L/min)
F=	117	**L/s**
F=	1,849	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 9
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC	
C=	1.0	
A*=	564	m^2 (Townhouse unit = 47 square m)
F=	5,000	**L/min** (rounded to nearest 1,000 L/min)

It is currently proposed that firewalls will be installed in between the townhouse units.

2) Occupancy Reduction/Surcharge

Contents Factor:		C			
Reduction/Surcharge of		0%	=	0	L/min
F=	**5000L/min +**	**0**	**L/min =**	5,000	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%		
Standard Water Supply:		NO	0%		
Fully Supervised:		NO	0%		
Total			0%		
Reduction of		0%	L/min =	0	L/min
F=	**5000L/min -**	**0**	**L/min =**	5,000	**L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	19	15%	
East	20	15%	
South	23	10%	(Charge based on firewall)
West	7	20%	
Total		60%	**of** **5000 L/min** = 3,000 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= **5000L/min +** **3000L/min** **=** 8,000 **L/min** (2,000L/min<F<45,000L/min)

F=	8,000	**L/min** (round to the nearest 1,000L/min)
F=	133	**L/s**
F=	2,113	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 9
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC	
C=	1.0	
A*=	351	m^2 (Townhouse unit = 47 square m)
F=	4,000	**L/min** (rounded to nearest 1,000 L/min)

2) Occupancy Reduction/Surcharge

Contents Factor:		C			
Reduction/Surcharge of		0%	=	0	L/min
F=	**4000L/min +**	**0**	**L/min =**	**4,000**	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%		
Standard Water Supply:		NO	0%		
Fully Supervised:		NO	0%		
Total			0%		
Reduction of		0%	L/min =	0	L/min
F=	**4000L/min -**	**0**	**L/min =**	**4,000**	**L/min**

4) Separation Charge

Building Face	Dist(m)	Charge			
North	18.5	15%			
East	7.6	20%			
South	31	5%			
West	3	25%			
Total		65%	**of**	**4000 L/min =**	**2,600 L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= **4000L/min +** **2600L/min** **=** **6,600 L/min** (2,000L/min<F<45,000L/min)

F=	**7,000**	**L/min**	(round to the nearest 1,000L/min)
F=	**117**	**L/s**	
F=	**1,849**	**gpm**	

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 11
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	773 m^2
F=	6,000 **L/min** (rounded to nearest 1,000 L/min)

2) Occupancy Reduction/Surcharge

Contents Factor:		C		
Reduction/Surcharge of		0%	=	0 L/min
F=	**6000L/min +**	**0**	**L/min =**	**6,000 L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%	
Standard Water Supply:		NO	0%	
Fully Supervised:		NO	0%	
Total			0%	
Reduction of		0%	L/min =	0 L/min
F=	**6000L/min -**	**0**	**L/min =**	**6,000 L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	15.5	15%	
East	3	25%	
South	35	5%	(Charge based on firewall)
West	16.7	15%	
Total		60%	**of 6000 L/min = 3,600 L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= **6000L/min +** **3600L/min** **=** 9,600 **L/min** (2,000L/min<F<45,000L/min)

F=	10,000	**L/min** (round to the nearest 1,000L/min)
F=	167	**L/s**
F=	2,642	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 12
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	502 m^2
F=	5,000 **L/min** (rounded to nearest 1,000 L/min)

2) Occupancy Reduction/Surcharge

Contents Factor:	C			
Reduction/Surcharge of	0%	=	0	L/min
F=	**5000L/min +**	**0**	**L/min =**	**5,000 L/min**

3) System Type Reduction

NFPA 13 Sprinkler:	NO	0%
Standard Water Supply:	NO	0%
Fully Supervised:	NO	0%
Total		0%

Reduction of	0%	L/min	=	0	L/min
F=	**5000L/min -**	**0**	**L/min =**	**5,000**	**L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	13.1	15%	
East	16.7	15%	
South	46	0%	(>45m)
West	58.8	0%	(>45m)
Total		30%	**of 5000 L/min = 1,500 L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= **5000L/min +** **1500L/min** **=** 6,500 **L/min** (2,000L/min<F<45,000L/min)

F=	7,000	**L/min** (round to the nearest 1,000L/min)
F=	117	**L/s**
F=	1,849	**gpm**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT TOWNHOUSE BLOCK 13
Fire Underwriters Survey

Project : **340 Mapleview Drive**
Project No: **21076**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	OC
C=	1.0
A*=	513 m^2
F=	5,000 **L/min** (rounded to nearest 1,000 L/min)

2) Occupancy Reduction/Surcharge

Contents Factor:		C		
Reduction/Surcharge of		0%	=	0 L/min
F=	**5000L/min +**	**0**	**L/min =**	**5,000 L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		NO	0%	
Standard Water Supply:		NO	0%	
Fully Supervised:		NO	0%	
Total			0%	
Reduction of		0%	L/min =	0 L/min
F=	**5000L/min -**	**0**	**L/min =**	**5,000 L/min**

4) Separation Charge

Building Face	Dist(m)	Charge	
North	18.5	15%	
East	58.8	0%	(>45m)
South	46	0%	(>45m)
West	25	10%	(Charge based on firewall)
Total		25%	**of 5000 L/min = 1,250 L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= **5000L/min +** **1250L/min** **=** 6,250 **L/min** (2,000L/min<F<45,000L/min)

F=	6,000	**L/min** (round to the nearest 1,000L/min)
F=	100	**L/s**
F=	1,585	**gpm**

counterpoint engineering

NFPA Theoretical Flow Calculations - Hydrant at Loon Avenue & Gadwall Avenue

Project Name: **340 Mapleview Drive**
Project Number: **21076**

Based on National Fire Protection Association Guidelines, the available flow at the minimum residual pressure of 20psi can be calculated based on the observed flow at the observed pressure readings, as follows:

$$Q_F = 29.83 \times c \times d^2 \times p^{0.5}$$, where

Q_F = observed flow (US GPM)
c = hydrant nozzle coefficient (0.90 - 0.95)
d = nozzle diameter (in)
p = observed pitot pressure

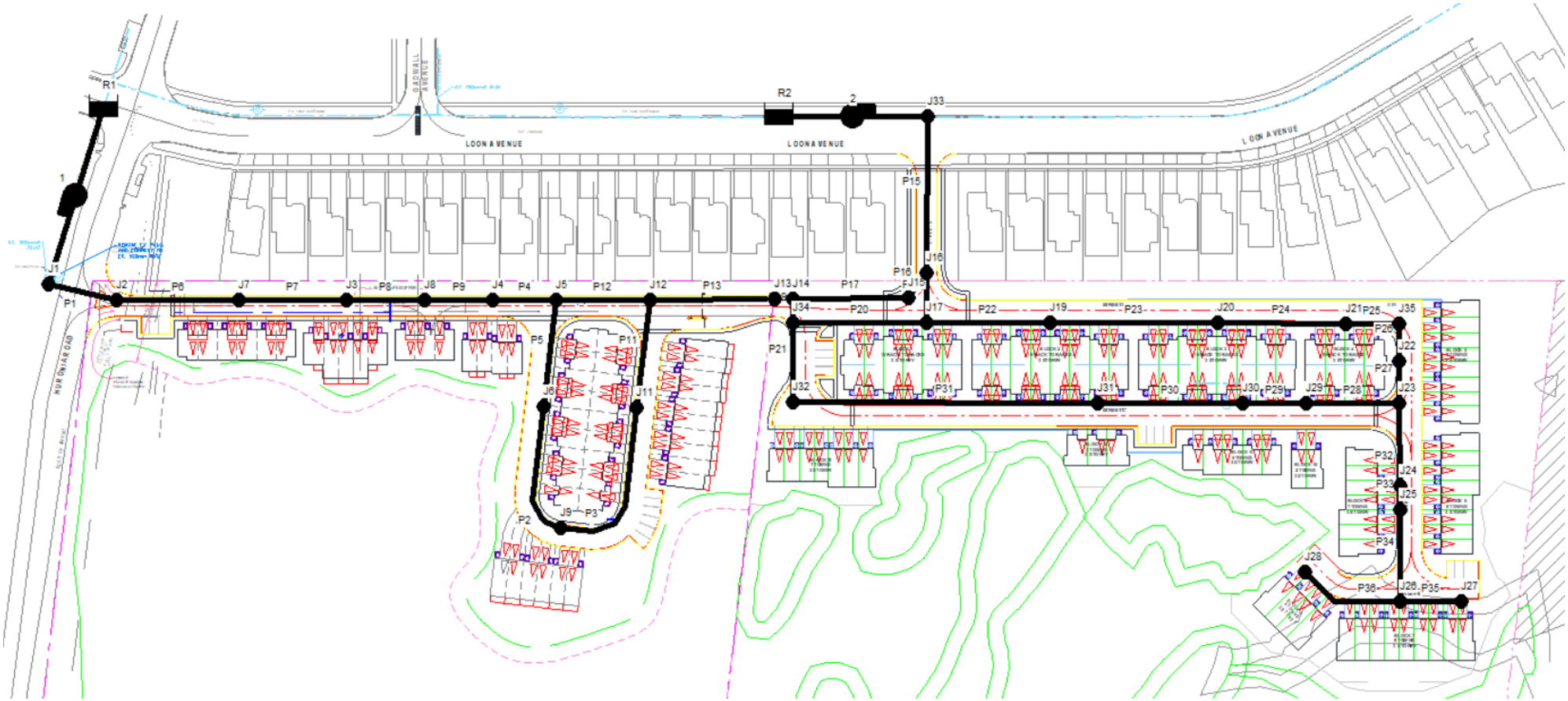
$$Q_R = Q_F \times h_F^{0.54} / h_R^{0.54}$$, where

Q_R = available flow
Q_F = observed flow (US GPM)
h_F = drop from measured static to desired baseline pressure
h_R = drop from measured static to measured residual pressure

Based on flow test results obtained by ViPond Inc., November 12, 2020

c =	0.9		
d =	2.5	in	
number of ports =	2		
p =	28		
Q_F =	**1786**	**US GPM**	
Measured Static Pressure =	73	psi	
Measured Residual Pressure =	68	psi	
Desired Residual Pressure =	20	psi	, minimum per City of Toronto design criteria
Q_R =	**6391**	**US GPM**	per fire connection
	24,194	**L/min**	

Proposed Conditions EPANET Model Network



Project No: 21076
January 2022

Prepared by: JL

Model Results Summary Tables

Residual Pressure Non-Fire Scenarios

Scenario	Lowest Pressure			Satisfies Pressure Requirements?
	Pressure (m H2O)	Pressure (psi)	**Pressure (kPa)**	
Max. Day	51.93	73.84	509.13	Yes
Peak Hour	51.91	73.81	508.93	Yes

Scenario	Highest Pressure			Satisfies Pressure Requirements?
	Pressure (m H2O)	Pressure (psi)	**Pressure (kPa)**	
Max. Day	59.62	84.78	584.52	Yes
Peak Hour	59.59	84.74	584.23	Yes

Notes:

1. Prefered design pressure during minimum hour and peak hour is 275 kPa to 700 kPA
2. The minimum pressure under any non-fire demand scenario should not be less than 275 kPa

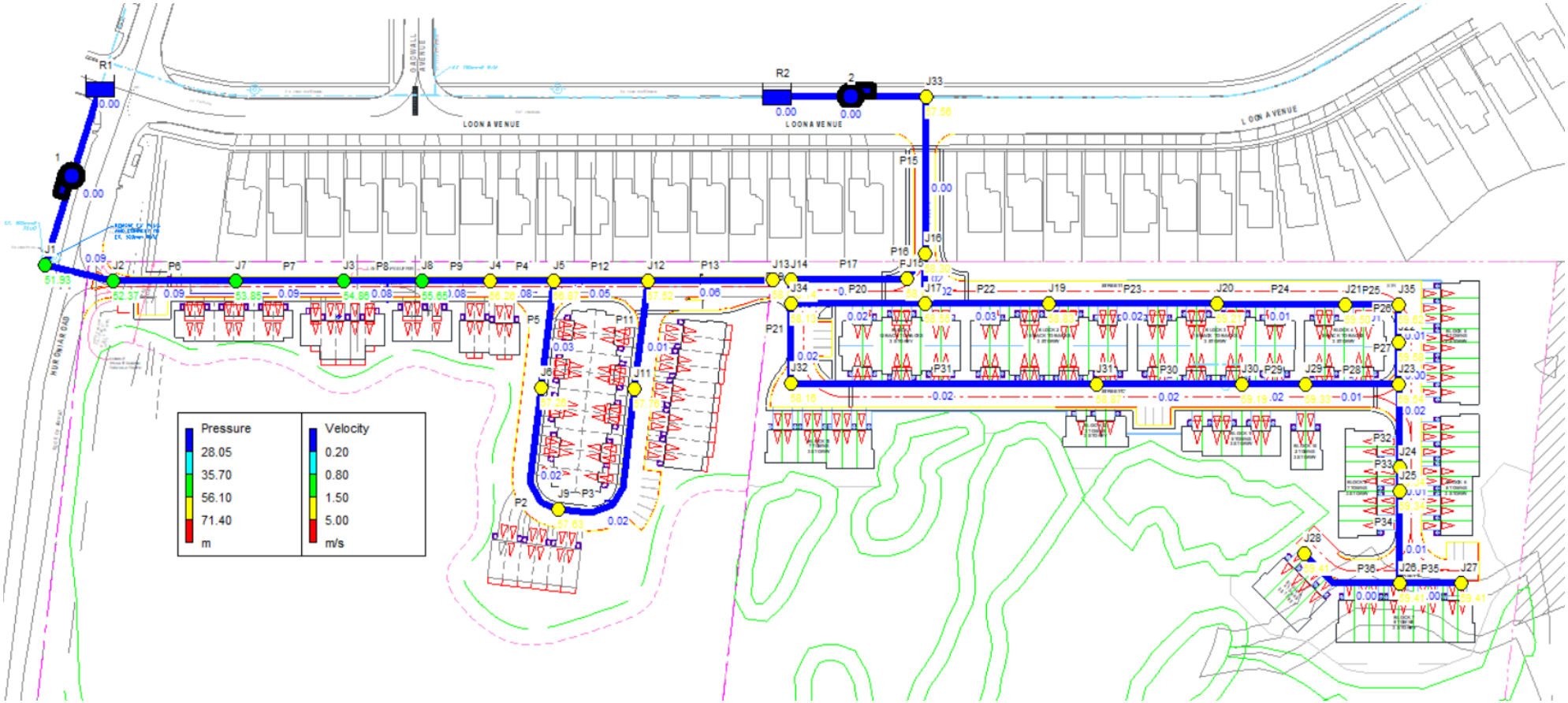
Residual Pressure based on Maximum Day Demand + Fire Flow

Fire Flow at Block / Node	Max. Velocity (m/s)	Lowest Pressure			Satisfies Pressure Requirements?
		Pressure (m H2O)	Pressure (psi)	**Pressure (kPa)**	
Block 2 / J20	4.03	39.54	56.22	387.66	Yes
Block 7 / J26	4.78	36.39	51.75	356.77	Yes
Block 8 / J28	3.72	41.52	59.04	407.07	Yes
Block 9 / J26	4.26	43.57	61.96	427.17	Yes
Block 11 / J30	3.13	41.79	59.42	409.71	Yes
EXT - Huronia Block 5 / J6	3.23	47.12	67.00	461.97	Yes
EXT - Huronia Block 6 / J9	1.87	51.18	72.78	501.78	Yes

Notes:

1. Fire flow requirements satisfied if lowest pressure in system > 140 kPa (20 psi)
2. Maximum allowable flow velocity during fire flow conditions equals 5 m/s

Maximum Day Demand Conditions Schematic



Project No: 21076
January 2022

Prepared by: JL

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*************************************************************************
*                          E P A N E T                                  *
*                    Hydraulic and Water Quality                        *
*                    Analysis for Pipe Networks                         *
*                         Version 2.2                                   *
*************************************************************************

Input File: 21076_Max Day.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	200
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	11.11	11.11	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	303.23	51.93	0.00
J2	0.00	303.22	52.37	0.00
J3	0.08	303.22	54.86	0.00
J4	0.07	303.22	56.26	0.00
J5	0.00	303.21	56.87	0.00
J6	0.30	303.21	57.26	0.00
J7	0.10	303.22	53.85	0.00
J8	0.05	303.22	55.65	0.00
J9	0.10	303.21	57.63	0.00
J11	0.17	303.21	57.76	0.00
J12	0.00	303.21	57.52	0.00
J13	0.00	303.21	58.06	0.00
J14	0.00	303.21	58.14	0.00
J15	0.00	303.21	58.45	0.00
J16	0.00	303.21	58.30	0.00
J17	0.22	303.21	58.55	0.00
J19	0.29	303.21	58.83	0.00
J20	0.29	303.21	59.21	0.00
J21	0.15	303.21	59.50	0.00
J22	0.15	303.21	59.58	0.00
J23	0.00	303.21	59.54	0.00
J24	0.15	303.21	59.34	0.00
J25	0.13	303.21	59.34	0.00
J26	0.18	303.21	59.41	0.00
J27	0.00	303.21	59.41	0.00
J28	0.05	303.21	59.41	0.00

J29	0.04	303.21	59.33	0.00	
J30	0.09	303.21	59.19	0.00	
J31	0.05	303.21	58.87	0.00	
J32	0.13	303.21	58.16	0.00	
J33	0.00	303.21	57.56	0.00	
J34	0.00	303.21	58.13	0.00	
J35	0.00	303.21	59.62	0.00	
R1	-2.80	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	2.80	0.09	0.08	Open
P4	2.50	0.08	0.07	Open
P5	0.93	0.03	0.01	Open
P6	2.80	0.09	0.08	Open
P7	2.70	0.09	0.08	Open
P8	2.62	0.08	0.07	Open
P9	2.57	0.08	0.07	Open
P2	0.63	0.02	0.01	Open
P11	0.36	0.01	0.00	Open
P12	1.57	0.05	0.03	Open
P13	1.93	0.06	0.04	Open
P14	1.93	0.06	0.04	Open
P15	0.00	0.00	0.00	Open
P16	-0.61	0.02	0.00	Open
P17	-0.61	0.02	0.01	Open
P18	0.61	0.02	0.01	Open
P19	1.32	0.04	0.02	Open
P20	-0.56	0.02	0.00	Open
P21	0.75	0.02	0.01	Open
P22	0.96	0.03	0.01	Open
P23	0.66	0.02	0.01	Open
P24	0.37	0.01	0.00	Open
P25	0.22	0.01	0.00	Open
P26	0.22	0.01	0.00	Open
P27	0.07	0.00	0.00	Open
P28	-0.44	0.01	0.00	Open
P29	-0.48	0.02	0.00	Open
P30	-0.57	0.02	0.00	Open
P31	0.63	0.02	0.01	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open

P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	0.52	0.02	0.00	Open
1	2.80	0.00	-303.23	Open Pump
2	0.00	0.00	0.00	Closed Pump

Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	303.23	51.93	0.00	
J2	0.00	303.22	52.37	0.00	
J3	0.08	303.22	54.86	0.00	
J4	0.07	303.22	56.26	0.00	
J5	0.00	303.21	56.87	0.00	
J6	0.30	303.21	57.26	0.00	
J7	0.10	303.22	53.85	0.00	
J8	0.05	303.22	55.65	0.00	
J9	0.10	303.21	57.63	0.00	
J11	0.17	303.21	57.76	0.00	
J12	0.00	303.21	57.52	0.00	
J13	0.00	303.21	58.06	0.00	
J14	0.00	303.21	58.14	0.00	
J15	0.00	303.21	58.45	0.00	
J16	0.00	303.21	58.30	0.00	
J17	0.22	303.21	58.55	0.00	
J19	0.29	303.21	58.83	0.00	
J20	0.29	303.21	59.21	0.00	
J21	0.15	303.21	59.50	0.00	
J22	0.15	303.21	59.58	0.00	
J23	0.00	303.21	59.54	0.00	
J24	0.15	303.21	59.34	0.00	
J25	0.13	303.21	59.34	0.00	
J26	0.18	303.21	59.41	0.00	
J27	0.00	303.21	59.41	0.00	
J28	0.05	303.21	59.41	0.00	
J29	0.04	303.21	59.33	0.00	
J30	0.09	303.21	59.19	0.00	
J31	0.05	303.21	58.87	0.00	
J32	0.13	303.21	58.16	0.00	
J33	0.00	303.21	57.56	0.00	
J34	0.00	303.21	58.13	0.00	
J35	0.00	303.21	59.62	0.00	
R1	-2.80	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	2.80	0.09	0.08	Open
P4	2.50	0.08	0.07	Open
P5	0.93	0.03	0.01	Open
P6	2.80	0.09	0.08	Open
P7	2.70	0.09	0.08	Open
P8	2.62	0.08	0.07	Open

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Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P9	2.57	0.08	0.07	Open
P2	0.63	0.02	0.01	Open
P11	0.36	0.01	0.00	Open
P12	1.57	0.05	0.03	Open
P13	1.93	0.06	0.04	Open
P14	1.93	0.06	0.04	Open
P15	0.00	0.00	0.00	Open
P16	-0.61	0.02	0.00	Open
P17	-0.61	0.02	0.01	Open
P18	0.61	0.02	0.01	Open
P19	1.32	0.04	0.02	Open
P20	-0.56	0.02	0.00	Open
P21	0.75	0.02	0.01	Open
P22	0.96	0.03	0.01	Open
P23	0.66	0.02	0.01	Open
P24	0.37	0.01	0.00	Open
P25	0.22	0.01	0.00	Open
P26	0.22	0.01	0.00	Open
P27	0.07	0.00	0.00	Open
P28	-0.44	0.01	0.00	Open
P29	-0.48	0.02	0.00	Open
P30	-0.57	0.02	0.00	Open
P31	0.63	0.02	0.01	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	0.52	0.02	0.00	Open
1	2.80	0.00	-303.23	Open Pump
2	0.00	0.00	0.00	Closed Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	303.23	51.93	0.00	
J2	0.00	303.22	52.37	0.00	
J3	0.08	303.22	54.86	0.00	
J4	0.07	303.22	56.26	0.00	
J5	0.00	303.21	56.87	0.00	
J6	0.30	303.21	57.26	0.00	
J7	0.10	303.22	53.85	0.00	
J8	0.05	303.22	55.65	0.00	
J9	0.10	303.21	57.63	0.00	
J11	0.17	303.21	57.76	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	303.21	57.52	0.00	
J13	0.00	303.21	58.06	0.00	
J14	0.00	303.21	58.14	0.00	
J15	0.00	303.21	58.45	0.00	
J16	0.00	303.21	58.30	0.00	
J17	0.22	303.21	58.55	0.00	
J19	0.29	303.21	58.83	0.00	
J20	0.29	303.21	59.21	0.00	
J21	0.15	303.21	59.50	0.00	
J22	0.15	303.21	59.58	0.00	
J23	0.00	303.21	59.54	0.00	
J24	0.15	303.21	59.34	0.00	
J25	0.13	303.21	59.34	0.00	
J26	0.18	303.21	59.41	0.00	
J27	0.00	303.21	59.41	0.00	
J28	0.05	303.21	59.41	0.00	
J29	0.04	303.21	59.33	0.00	
J30	0.09	303.21	59.19	0.00	
J31	0.05	303.21	58.87	0.00	
J32	0.13	303.21	58.16	0.00	
J33	0.00	303.21	57.56	0.00	
J34	0.00	303.21	58.13	0.00	
J35	0.00	303.21	59.62	0.00	
R1	-2.80	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	2.80	0.09	0.08	Open
P4	2.50	0.08	0.07	Open
P5	0.93	0.03	0.01	Open
P6	2.80	0.09	0.08	Open
P7	2.70	0.09	0.08	Open
P8	2.62	0.08	0.07	Open
P9	2.57	0.08	0.07	Open
P2	0.63	0.02	0.01	Open
P11	0.36	0.01	0.00	Open
P12	1.57	0.05	0.03	Open
P13	1.93	0.06	0.04	Open
P14	1.93	0.06	0.04	Open
P15	0.00	0.00	0.00	Open
P16	-0.61	0.02	0.00	Open
P17	-0.61	0.02	0.01	Open
P18	0.61	0.02	0.01	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	1.32	0.04	0.02	Open
P20	-0.56	0.02	0.00	Open
P21	0.75	0.02	0.01	Open
P22	0.96	0.03	0.01	Open
P23	0.66	0.02	0.01	Open
P24	0.37	0.01	0.00	Open
P25	0.22	0.01	0.00	Open
P26	0.22	0.01	0.00	Open
P27	0.07	0.00	0.00	Open
P28	-0.44	0.01	0.00	Open
P29	-0.48	0.02	0.00	Open
P30	-0.57	0.02	0.00	Open
P31	0.63	0.02	0.01	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	0.52	0.02	0.00	Open
1	2.80	0.00	-303.23	Open Pump
2	0.00	0.00	0.00	Closed Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	303.23	51.93	0.00	
J2	0.00	303.22	52.37	0.00	
J3	0.08	303.22	54.86	0.00	
J4	0.07	303.22	56.26	0.00	
J5	0.00	303.21	56.87	0.00	
J6	0.30	303.21	57.26	0.00	
J7	0.10	303.22	53.85	0.00	
J8	0.05	303.22	55.65	0.00	
J9	0.10	303.21	57.63	0.00	
J11	0.17	303.21	57.76	0.00	
J12	0.00	303.21	57.52	0.00	
J13	0.00	303.21	58.06	0.00	
J14	0.00	303.21	58.14	0.00	
J15	0.00	303.21	58.45	0.00	
J16	0.00	303.21	58.30	0.00	
J17	0.22	303.21	58.55	0.00	
J19	0.29	303.21	58.83	0.00	
J20	0.29	303.21	59.21	0.00	
J21	0.15	303.21	59.50	0.00	
J22	0.15	303.21	59.58	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	303.21	59.54	0.00	
J24	0.15	303.21	59.34	0.00	
J25	0.13	303.21	59.34	0.00	
J26	0.18	303.21	59.41	0.00	
J27	0.00	303.21	59.41	0.00	
J28	0.05	303.21	59.41	0.00	
J29	0.04	303.21	59.33	0.00	
J30	0.09	303.21	59.19	0.00	
J31	0.05	303.21	58.87	0.00	
J32	0.13	303.21	58.16	0.00	
J33	0.00	303.21	57.56	0.00	
J34	0.00	303.21	58.13	0.00	
J35	0.00	303.21	59.62	0.00	
R1	-2.80	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	2.80	0.09	0.08	Open
P4	2.50	0.08	0.07	Open
P5	0.93	0.03	0.01	Open
P6	2.80	0.09	0.08	Open
P7	2.70	0.09	0.08	Open
P8	2.62	0.08	0.07	Open
P9	2.57	0.08	0.07	Open
P2	0.63	0.02	0.01	Open
P11	0.36	0.01	0.00	Open
P12	1.57	0.05	0.03	Open
P13	1.93	0.06	0.04	Open
P14	1.93	0.06	0.04	Open
P15	0.00	0.00	0.00	Open
P16	-0.61	0.02	0.00	Open
P17	-0.61	0.02	0.01	Open
P18	0.61	0.02	0.01	Open
P19	1.32	0.04	0.02	Open
P20	-0.56	0.02	0.00	Open
P21	0.75	0.02	0.01	Open
P22	0.96	0.03	0.01	Open
P23	0.66	0.02	0.01	Open
P24	0.37	0.01	0.00	Open
P25	0.22	0.01	0.00	Open
P26	0.22	0.01	0.00	Open
P27	0.07	0.00	0.00	Open
P28	-0.44	0.01	0.00	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	-0.48	0.02	0.00	Open
P30	-0.57	0.02	0.00	Open
P31	0.63	0.02	0.01	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	0.52	0.02	0.00	Open
1	2.80	0.00	-303.23	Open Pump
2	0.00	0.00	0.00	Closed Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	303.23	51.93	0.00	
J2	0.00	303.22	52.37	0.00	
J3	0.08	303.22	54.86	0.00	
J4	0.07	303.22	56.26	0.00	
J5	0.00	303.21	56.87	0.00	
J6	0.30	303.21	57.26	0.00	
J7	0.10	303.22	53.85	0.00	
J8	0.05	303.22	55.65	0.00	
J9	0.10	303.21	57.63	0.00	
J11	0.17	303.21	57.76	0.00	
J12	0.00	303.21	57.52	0.00	
J13	0.00	303.21	58.06	0.00	
J14	0.00	303.21	58.14	0.00	
J15	0.00	303.21	58.45	0.00	
J16	0.00	303.21	58.30	0.00	
J17	0.22	303.21	58.55	0.00	
J19	0.29	303.21	58.83	0.00	
J20	0.29	303.21	59.21	0.00	
J21	0.15	303.21	59.50	0.00	
J22	0.15	303.21	59.58	0.00	
J23	0.00	303.21	59.54	0.00	
J24	0.15	303.21	59.34	0.00	
J25	0.13	303.21	59.34	0.00	
J26	0.18	303.21	59.41	0.00	
J27	0.00	303.21	59.41	0.00	
J28	0.05	303.21	59.41	0.00	
J29	0.04	303.21	59.33	0.00	
J30	0.09	303.21	59.19	0.00	
J31	0.05	303.21	58.87	0.00	
J32	0.13	303.21	58.16	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	303.21	57.56	0.00	
J34	0.00	303.21	58.13	0.00	
J35	0.00	303.21	59.62	0.00	
R1	-2.80	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

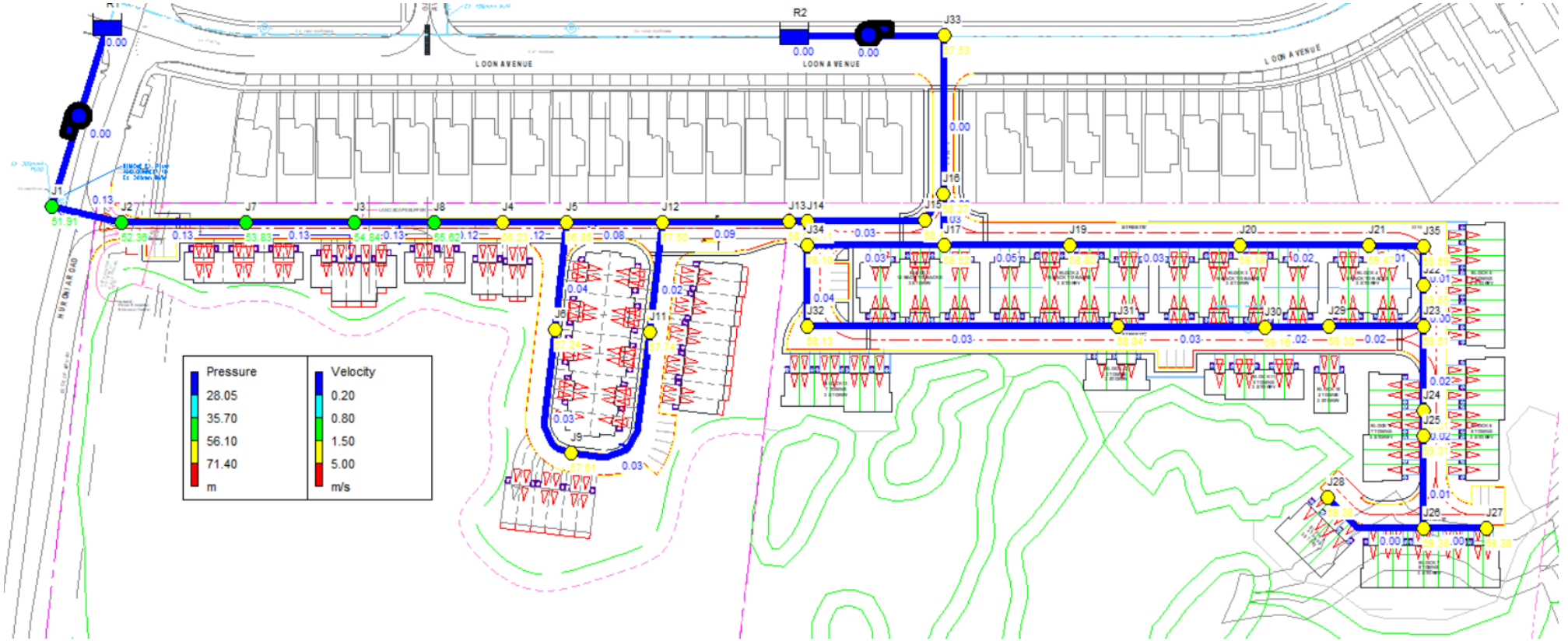
Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	2.80	0.09	0.08	Open
P4	2.50	0.08	0.07	Open
P5	0.93	0.03	0.01	Open
P6	2.80	0.09	0.08	Open
P7	2.70	0.09	0.08	Open
P8	2.62	0.08	0.07	Open
P9	2.57	0.08	0.07	Open
P2	0.63	0.02	0.01	Open
P11	0.36	0.01	0.00	Open
P12	1.57	0.05	0.03	Open
P13	1.93	0.06	0.04	Open
P14	1.93	0.06	0.04	Open
P15	0.00	0.00	0.00	Open
P16	-0.61	0.02	0.00	Open
P17	-0.61	0.02	0.01	Open
P18	0.61	0.02	0.01	Open
P19	1.32	0.04	0.02	Open
P20	-0.56	0.02	0.00	Open
P21	0.75	0.02	0.01	Open
P22	0.96	0.03	0.01	Open
P23	0.66	0.02	0.01	Open
P24	0.37	0.01	0.00	Open
P25	0.22	0.01	0.00	Open
P26	0.22	0.01	0.00	Open
P27	0.07	0.00	0.00	Open
P28	-0.44	0.01	0.00	Open
P29	-0.48	0.02	0.00	Open
P30	-0.57	0.02	0.00	Open
P31	0.63	0.02	0.01	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	0.52	0.02	0.00	Open
1	2.80	0.00	-303.23	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	0.00	0.00	0.00	Closed Pump

Peak Hour Demand Conditions Schematic



Project No: 21076
January 2022

Prepared by: JL

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*************************************************************************
*                          E P A N E T                                  *
*                    Hydraulic and Water Quality                        *
*                    Analysis for Pipe Networks                         *
*                         Version 2.2                                   *
*************************************************************************

Input File: 21076_Peak Hour.net
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Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	200
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	16.69	16.69	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	303.21	51.91	0.00
J2	0.00	303.21	52.36	0.00
J3	0.13	303.20	54.84	0.00
J4	0.10	303.19	56.23	0.00
J5	0.00	303.19	56.85	0.00
J6	0.45	303.19	57.24	0.00
J7	0.15	303.20	53.83	0.00
J8	0.08	303.19	55.62	0.00
J9	0.15	303.19	57.61	0.00
J11	0.25	303.19	57.74	0.00
J12	0.00	303.19	57.50	0.00
J13	0.00	303.18	58.03	0.00
J14	0.00	303.18	58.11	0.00
J15	0.00	303.18	58.42	0.00
J16	0.00	303.18	58.27	0.00
J17	0.33	303.18	58.52	0.00
J19	0.44	303.18	58.80	0.00
J20	0.44	303.18	59.18	0.00
J21	0.22	303.18	59.47	0.00
J22	0.22	303.18	59.55	0.00
J23	0.00	303.18	59.51	0.00
J24	0.22	303.18	59.31	0.00
J25	0.19	303.18	59.31	0.00
J26	0.28	303.18	59.38	0.00
J27	0.00	303.18	59.38	0.00
J28	0.08	303.18	59.38	0.00

J29	0.05	303.18	59.30	0.00	
J30	0.14	303.18	59.16	0.00	
J31	0.08	303.18	58.84	0.00	
J32	0.19	303.18	58.13	0.00	
J33	0.00	303.18	57.53	0.00	
J34	0.00	303.18	58.10	0.00	
J35	0.00	303.18	59.59	0.00	
R1	-4.21	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

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Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	4.21	0.13	0.18	Open
P4	3.76	0.12	0.15	Open
P5	1.39	0.04	0.02	Open
P6	4.21	0.13	0.18	Open
P7	4.06	0.13	0.17	Open
P8	3.93	0.13	0.16	Open
P9	3.86	0.12	0.15	Open
P2	0.94	0.03	0.01	Open
P11	0.54	0.02	0.00	Open
P12	2.36	0.08	0.06	Open
P13	2.90	0.09	0.09	Open
P14	2.90	0.09	0.09	Open
P15	0.00	0.00	0.00	Open
P16	-0.92	0.03	0.01	Open
P17	-0.92	0.03	0.01	Open
P18	0.92	0.03	0.01	Open
P19	1.98	0.06	0.04	Open
P20	-0.85	0.03	0.01	Open
P21	1.13	0.04	0.02	Open
P22	1.43	0.05	0.02	Open
P23	0.99	0.03	0.01	Open
P24	0.55	0.02	0.00	Open
P25	0.33	0.01	0.00	Open
P26	0.33	0.01	0.00	Open
P27	0.11	0.00	0.00	Open
P28	-0.66	0.02	0.01	Open
P29	-0.72	0.02	0.01	Open
P30	-0.86	0.03	0.01	Open
P31	0.94	0.03	0.01	Open
P32	0.77	0.02	0.01	Open
P33	0.55	0.02	0.00	Open
P34	0.36	0.01	0.00	Open

P35	0.00	0.00	0.00	Open
P36	0.08	0.00	0.00	Open
P3	0.79	0.03	0.01	Open
1	4.21	0.00	-303.21	Open Pump
2	0.00	0.00	0.00	Closed Pump

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Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	303.21	51.91	0.00	
J2	0.00	303.21	52.36	0.00	
J3	0.13	303.20	54.84	0.00	
J4	0.10	303.19	56.23	0.00	
J5	0.00	303.19	56.85	0.00	
J6	0.45	303.19	57.24	0.00	
J7	0.15	303.20	53.83	0.00	
J8	0.08	303.19	55.62	0.00	
J9	0.15	303.19	57.61	0.00	
J11	0.25	303.19	57.74	0.00	
J12	0.00	303.19	57.50	0.00	
J13	0.00	303.18	58.03	0.00	
J14	0.00	303.18	58.11	0.00	
J15	0.00	303.18	58.42	0.00	
J16	0.00	303.18	58.27	0.00	
J17	0.33	303.18	58.52	0.00	
J19	0.44	303.18	58.80	0.00	
J20	0.44	303.18	59.18	0.00	
J21	0.22	303.18	59.47	0.00	
J22	0.22	303.18	59.55	0.00	
J23	0.00	303.18	59.51	0.00	
J24	0.22	303.18	59.31	0.00	
J25	0.19	303.18	59.31	0.00	
J26	0.28	303.18	59.38	0.00	
J27	0.00	303.18	59.38	0.00	
J28	0.08	303.18	59.38	0.00	
J29	0.05	303.18	59.30	0.00	
J30	0.14	303.18	59.16	0.00	
J31	0.08	303.18	58.84	0.00	
J32	0.19	303.18	58.13	0.00	
J33	0.00	303.18	57.53	0.00	
J34	0.00	303.18	58.10	0.00	
J35	0.00	303.18	59.59	0.00	
R1	-4.21	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	4.21	0.13	0.18	Open
P4	3.76	0.12	0.15	Open
P5	1.39	0.04	0.02	Open
P6	4.21	0.13	0.18	Open
P7	4.06	0.13	0.17	Open
P8	3.93	0.13	0.16	Open

Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P9	3.86	0.12	0.15	Open
P2	0.94	0.03	0.01	Open
P11	0.54	0.02	0.00	Open
P12	2.36	0.08	0.06	Open
P13	2.90	0.09	0.09	Open
P14	2.90	0.09	0.09	Open
P15	0.00	0.00	0.00	Open
P16	-0.92	0.03	0.01	Open
P17	-0.92	0.03	0.01	Open
P18	0.92	0.03	0.01	Open
P19	1.98	0.06	0.05	Open
P20	-0.85	0.03	0.01	Open
P21	1.13	0.04	0.02	Open
P22	1.43	0.05	0.02	Open
P23	0.99	0.03	0.01	Open
P24	0.55	0.02	0.00	Open
P25	0.33	0.01	0.00	Open
P26	0.33	0.01	0.00	Open
P27	0.11	0.00	0.00	Open
P28	-0.66	0.02	0.01	Open
P29	-0.72	0.02	0.01	Open
P30	-0.86	0.03	0.01	Open
P31	0.94	0.03	0.01	Open
P32	0.77	0.02	0.01	Open
P33	0.55	0.02	0.00	Open
P34	0.36	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.08	0.00	0.00	Open
P3	0.79	0.03	0.01	Open
1	4.21	0.00	-303.21	Open Pump
2	0.00	0.00	0.00	Closed Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	303.21	51.91	0.00	
J2	0.00	303.21	52.36	0.00	
J3	0.13	303.20	54.84	0.00	
J4	0.10	303.19	56.23	0.00	
J5	0.00	303.19	56.85	0.00	
J6	0.45	303.19	57.24	0.00	
J7	0.15	303.20	53.83	0.00	
J8	0.08	303.19	55.62	0.00	
J9	0.15	303.19	57.61	0.00	
J11	0.25	303.19	57.74	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	303.19	57.50	0.00	
J13	0.00	303.18	58.03	0.00	
J14	0.00	303.18	58.11	0.00	
J15	0.00	303.18	58.42	0.00	
J16	0.00	303.18	58.27	0.00	
J17	0.33	303.18	58.52	0.00	
J19	0.44	303.18	58.80	0.00	
J20	0.44	303.18	59.18	0.00	
J21	0.22	303.18	59.47	0.00	
J22	0.22	303.18	59.55	0.00	
J23	0.00	303.18	59.51	0.00	
J24	0.22	303.18	59.31	0.00	
J25	0.19	303.18	59.31	0.00	
J26	0.28	303.18	59.38	0.00	
J27	0.00	303.18	59.38	0.00	
J28	0.08	303.18	59.38	0.00	
J29	0.05	303.18	59.30	0.00	
J30	0.14	303.18	59.16	0.00	
J31	0.08	303.18	58.84	0.00	
J32	0.19	303.18	58.13	0.00	
J33	0.00	303.18	57.53	0.00	
J34	0.00	303.18	58.10	0.00	
J35	0.00	303.18	59.59	0.00	
R1	-4.21	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	4.21	0.13	0.18	Open
P4	3.76	0.12	0.15	Open
P5	1.39	0.04	0.02	Open
P6	4.21	0.13	0.18	Open
P7	4.06	0.13	0.17	Open
P8	3.93	0.13	0.16	Open
P9	3.86	0.12	0.15	Open
P2	0.94	0.03	0.01	Open
P11	0.54	0.02	0.00	Open
P12	2.36	0.08	0.06	Open
P13	2.90	0.09	0.09	Open
P14	2.90	0.09	0.09	Open
P15	0.00	0.00	0.00	Open
P16	-0.92	0.03	0.01	Open
P17	-0.92	0.03	0.01	Open
P18	0.92	0.03	0.01	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	1.98	0.06	0.04	Open
P20	-0.85	0.03	0.01	Open
P21	1.13	0.04	0.02	Open
P22	1.43	0.05	0.02	Open
P23	0.99	0.03	0.01	Open
P24	0.55	0.02	0.00	Open
P25	0.33	0.01	0.00	Open
P26	0.33	0.01	0.00	Open
P27	0.11	0.00	0.00	Open
P28	-0.66	0.02	0.01	Open
P29	-0.72	0.02	0.01	Open
P30	-0.86	0.03	0.01	Open
P31	0.94	0.03	0.01	Open
P32	0.77	0.02	0.01	Open
P33	0.55	0.02	0.00	Open
P34	0.36	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.08	0.00	0.00	Open
P3	0.79	0.03	0.01	Open
1	4.21	0.00	-303.21	Open Pump
2	0.00	0.00	0.00	Closed Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	303.21	51.91	0.00	
J2	0.00	303.21	52.36	0.00	
J3	0.13	303.20	54.84	0.00	
J4	0.10	303.19	56.23	0.00	
J5	0.00	303.19	56.85	0.00	
J6	0.45	303.19	57.24	0.00	
J7	0.15	303.20	53.83	0.00	
J8	0.08	303.19	55.62	0.00	
J9	0.15	303.19	57.61	0.00	
J11	0.25	303.19	57.74	0.00	
J12	0.00	303.19	57.50	0.00	
J13	0.00	303.18	58.03	0.00	
J14	0.00	303.18	58.11	0.00	
J15	0.00	303.18	58.42	0.00	
J16	0.00	303.18	58.27	0.00	
J17	0.33	303.18	58.52	0.00	
J19	0.44	303.18	58.80	0.00	
J20	0.44	303.18	59.18	0.00	
J21	0.22	303.18	59.47	0.00	
J22	0.22	303.18	59.55	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	303.18	59.51	0.00	
J24	0.22	303.18	59.31	0.00	
J25	0.19	303.18	59.31	0.00	
J26	0.28	303.18	59.38	0.00	
J27	0.00	303.18	59.38	0.00	
J28	0.08	303.18	59.38	0.00	
J29	0.05	303.18	59.30	0.00	
J30	0.14	303.18	59.16	0.00	
J31	0.08	303.18	58.84	0.00	
J32	0.19	303.18	58.13	0.00	
J33	0.00	303.18	57.53	0.00	
J34	0.00	303.18	58.10	0.00	
J35	0.00	303.18	59.59	0.00	
R1	-4.21	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	4.21	0.13	0.18	Open
P4	3.76	0.12	0.15	Open
P5	1.39	0.04	0.02	Open
P6	4.21	0.13	0.18	Open
P7	4.06	0.13	0.17	Open
P8	3.93	0.13	0.16	Open
P9	3.86	0.12	0.15	Open
P2	0.94	0.03	0.01	Open
P11	0.54	0.02	0.00	Open
P12	2.36	0.08	0.06	Open
P13	2.90	0.09	0.09	Open
P14	2.90	0.09	0.09	Open
P15	0.00	0.00	0.00	Open
P16	-0.92	0.03	0.01	Open
P17	-0.92	0.03	0.01	Open
P18	0.92	0.03	0.01	Open
P19	1.98	0.06	0.04	Open
P20	-0.85	0.03	0.01	Open
P21	1.13	0.04	0.02	Open
P22	1.43	0.05	0.02	Open
P23	0.99	0.03	0.01	Open
P24	0.55	0.02	0.00	Open
P25	0.33	0.01	0.00	Open
P26	0.33	0.01	0.00	Open
P27	0.11	0.00	0.00	Open
P28	-0.66	0.02	0.01	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	-0.72	0.02	0.01	Open
P30	-0.86	0.03	0.01	Open
P31	0.94	0.03	0.01	Open
P32	0.77	0.02	0.01	Open
P33	0.55	0.02	0.00	Open
P34	0.36	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.08	0.00	0.00	Open
P3	0.79	0.03	0.01	Open
1	4.21	0.00	-303.21	Open Pump
2	0.00	0.00	0.00	Closed Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	303.21	51.91	0.00	
J2	0.00	303.21	52.36	0.00	
J3	0.13	303.20	54.84	0.00	
J4	0.10	303.19	56.23	0.00	
J5	0.00	303.19	56.85	0.00	
J6	0.45	303.19	57.24	0.00	
J7	0.15	303.20	53.83	0.00	
J8	0.08	303.19	55.62	0.00	
J9	0.15	303.19	57.61	0.00	
J11	0.25	303.19	57.74	0.00	
J12	0.00	303.19	57.50	0.00	
J13	0.00	303.18	58.03	0.00	
J14	0.00	303.18	58.11	0.00	
J15	0.00	303.18	58.42	0.00	
J16	0.00	303.18	58.27	0.00	
J17	0.33	303.18	58.52	0.00	
J19	0.44	303.18	58.80	0.00	
J20	0.44	303.18	59.18	0.00	
J21	0.22	303.18	59.47	0.00	
J22	0.22	303.18	59.55	0.00	
J23	0.00	303.18	59.51	0.00	
J24	0.22	303.18	59.31	0.00	
J25	0.19	303.18	59.31	0.00	
J26	0.28	303.18	59.38	0.00	
J27	0.00	303.18	59.38	0.00	
J28	0.08	303.18	59.38	0.00	
J29	0.05	303.18	59.30	0.00	
J30	0.14	303.18	59.16	0.00	
J31	0.08	303.18	58.84	0.00	
J32	0.19	303.18	58.13	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	303.18	57.53	0.00	
J34	0.00	303.18	58.10	0.00	
J35	0.00	303.18	59.59	0.00	
R1	-4.21	0.00	0.00	0.00	Reservoir
R2	0.00	0.00	0.00	0.00	Reservoir

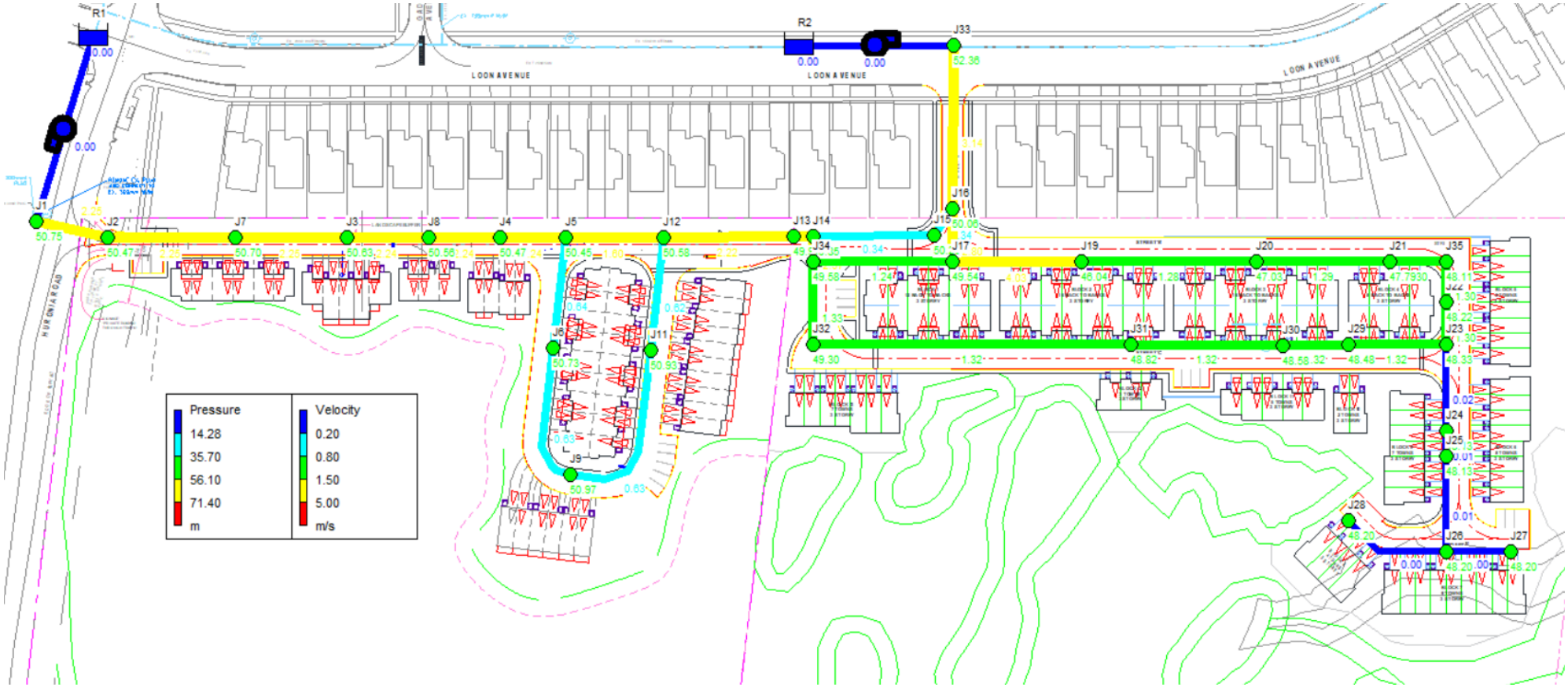
Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	4.21	0.13	0.18	Open
P4	3.76	0.12	0.14	Open
P5	1.39	0.04	0.02	Open
P6	4.21	0.13	0.18	Open
P7	4.06	0.13	0.17	Open
P8	3.93	0.13	0.16	Open
P9	3.86	0.12	0.15	Open
P2	0.94	0.03	0.01	Open
P11	0.54	0.02	0.00	Open
P12	2.36	0.08	0.06	Open
P13	2.90	0.09	0.09	Open
P14	2.90	0.09	0.09	Open
P15	0.00	0.00	0.00	Open
P16	-0.92	0.03	0.01	Open
P17	-0.92	0.03	0.01	Open
P18	0.92	0.03	0.01	Open
P19	1.98	0.06	0.04	Open
P20	-0.85	0.03	0.01	Open
P21	1.13	0.04	0.02	Open
P22	1.43	0.05	0.02	Open
P23	0.99	0.03	0.01	Open
P24	0.55	0.02	0.00	Open
P25	0.33	0.01	0.00	Open
P26	0.33	0.01	0.00	Open
P27	0.11	0.00	0.00	Open
P28	-0.66	0.02	0.01	Open
P29	-0.72	0.02	0.01	Open
P30	-0.86	0.03	0.01	Open
P31	0.94	0.03	0.01	Open
P32	0.77	0.02	0.01	Open
P33	0.55	0.02	0.00	Open
P34	0.36	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.08	0.00	0.00	Open
P3	0.79	0.03	0.01	Open
1	4.21	0.00	-303.21	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	0.00	0.00	0.00	Closed Pump

Max Day + Fire Flow Demand Conditions at Block 2 (J19) Schematic



Project No: 21076
January 2022

Prepared by: JL

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**************************************************************************
*                            E P A N E T                                 *
*                     Hydraulic and Water Quality                        *
*                     Analysis for Pipe Networks                         *
*                           Version 2.2                                  *
**************************************************************************

Input File: 21076_Max Day + Fire @ Block 2.net
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Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	200
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	279.14	279.14	0.00
2	100.00	75.00	1.08	384.67	384.67	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	302.05	50.75	0.00
J2	0.00	301.32	50.47	0.00
J3	0.08	298.99	50.63	0.00
J4	0.07	297.43	50.47	0.00
J5	0.00	296.79	50.45	0.00
J6	0.30	296.68	50.73	0.00
J7	0.10	300.07	50.70	0.00
J8	0.05	298.13	50.56	0.00
J9	0.10	296.55	50.97	0.00
J11	0.17	296.38	50.93	0.00
J12	0.00	296.27	50.58	0.00
J13	0.00	295.10	49.95	0.00
J14	0.00	294.92	49.85	0.00
J15	0.00	294.96	50.20	0.00
J16	0.00	294.97	50.06	0.00
J17	0.22	294.20	49.54	0.00
J19	166.96	290.42	46.04	0.00
J20	0.29	291.03	47.03	0.00
J21	0.15	291.50	47.79	0.00
J22	0.15	291.85	48.22	0.00
J23	0.00	292.00	48.33	0.00
J24	0.15	292.00	48.13	0.00
J25	0.13	292.00	48.13	0.00
J26	0.18	292.00	48.20	0.00
J27	0.00	292.00	48.20	0.00
J28	0.05	292.00	48.20	0.00

J29	0.04	292.36	48.48	0.00	
J30	0.09	292.60	48.58	0.00	
J31	0.05	293.16	48.82	0.00	
J32	0.13	294.35	49.30	0.00	
J33	0.00	298.01	52.36	0.00	
J34	0.00	294.66	49.58	0.00	
J35	0.00	291.70	48.11	0.00	
R1	-70.71	0.00	0.00	0.00	Reservoir
R2	-98.76	0.00	0.00	0.00	Reservoir

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Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	70.71	2.25	33.21	Open
P4	70.41	2.24	32.95	Open
P5	20.14	0.64	3.25	Open
P6	70.71	2.25	33.21	Open
P7	70.61	2.25	33.12	Open
P8	70.52	2.24	33.05	Open
P9	70.47	2.24	33.01	Open
P2	19.84	0.63	3.16	Open
P11	19.57	0.62	3.08	Open
P12	50.26	1.60	17.65	Open
P13	69.84	2.22	32.46	Open
P14	69.84	2.22	32.46	Open
P15	98.76	3.14	61.66	Open
P16	10.76	0.34	1.02	Open
P17	10.76	0.34	1.02	Open
P18	88.00	2.80	49.80	Open
P19	80.60	2.57	42.33	Open
P20	-38.88	1.24	10.97	Open
P21	41.72	1.33	12.50	Open
P22	126.66	4.03	97.75	Open
P23	-40.30	1.28	11.73	Open
P24	-40.60	1.29	11.88	Open
P25	-40.74	1.30	11.96	Open
P26	-40.74	1.30	11.96	Open
P27	-40.89	1.30	12.04	Open
P28	-41.41	1.32	12.33	Open
P29	-41.44	1.32	12.35	Open
P30	-41.53	1.32	12.40	Open
P31	41.59	1.32	12.43	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open

P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.74	0.63	3.13	Open
1	70.71	0.00	-302.05	Open Pump
2	98.76	0.00	-298.01	Open Pump

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Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.05	50.75	0.00	
J2	0.00	301.32	50.47	0.00	
J3	0.08	298.99	50.63	0.00	
J4	0.07	297.43	50.47	0.00	
J5	0.00	296.79	50.45	0.00	
J6	0.30	296.68	50.73	0.00	
J7	0.10	300.07	50.70	0.00	
J8	0.05	298.13	50.56	0.00	
J9	0.10	296.55	50.97	0.00	
J11	0.17	296.38	50.93	0.00	
J12	0.00	296.27	50.58	0.00	
J13	0.00	295.10	49.95	0.00	
J14	0.00	294.92	49.85	0.00	
J15	0.00	294.96	50.20	0.00	
J16	0.00	294.97	50.06	0.00	
J17	0.22	294.20	49.54	0.00	
J19	166.96	290.42	46.04	0.00	
J20	0.29	291.03	47.03	0.00	
J21	0.15	291.50	47.79	0.00	
J22	0.15	291.85	48.22	0.00	
J23	0.00	292.00	48.33	0.00	
J24	0.15	292.00	48.13	0.00	
J25	0.13	292.00	48.13	0.00	
J26	0.18	292.00	48.20	0.00	
J27	0.00	292.00	48.20	0.00	
J28	0.05	292.00	48.20	0.00	
J29	0.04	292.36	48.48	0.00	
J30	0.09	292.60	48.58	0.00	
J31	0.05	293.16	48.82	0.00	
J32	0.13	294.35	49.30	0.00	
J33	0.00	298.01	52.36	0.00	
J34	0.00	294.66	49.58	0.00	
J35	0.00	291.70	48.11	0.00	
R1	-70.71	0.00	0.00	0.00	Reservoir
R2	-98.76	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status	
P1	70.71	2.25	33.21	Open	
P4	70.41	2.24	32.95	Open	
P5	20.14	0.64	3.25	Open	
P6	70.71	2.25	33.21	Open	
P7	70.61	2.25	33.12	Open	
P8	70.52	2.24	33.05	Open	

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Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status	
P9	70.47	2.24	33.01	Open	
P2	19.84	0.63	3.16	Open	
P11	19.57	0.62	3.08	Open	
P12	50.26	1.60	17.65	Open	
P13	69.84	2.22	32.46	Open	
P14	69.84	2.22	32.46	Open	
P15	98.76	3.14	61.66	Open	
P16	10.76	0.34	1.02	Open	
P17	10.76	0.34	1.02	Open	
P18	88.00	2.80	49.80	Open	
P19	80.60	2.57	42.33	Open	
P20	-38.88	1.24	10.97	Open	
P21	41.72	1.33	12.50	Open	
P22	126.66	4.03	97.75	Open	
P23	-40.30	1.28	11.73	Open	
P24	-40.60	1.29	11.88	Open	
P25	-40.74	1.30	11.96	Open	
P26	-40.74	1.30	11.96	Open	
P27	-40.89	1.30	12.04	Open	
P28	-41.41	1.32	12.33	Open	
P29	-41.44	1.32	12.35	Open	
P30	-41.53	1.32	12.40	Open	
P31	41.59	1.32	12.43	Open	
P32	0.52	0.02	0.00	Open	
P33	0.37	0.01	0.00	Open	
P34	0.24	0.01	0.00	Open	
P35	0.00	0.00	0.00	Open	
P36	0.05	0.00	0.00	Open	
P3	19.74	0.63	3.13	Open	
1	70.71	0.00	-302.05	Open	Pump
2	98.76	0.00	-298.01	Open	Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.05	50.75	0.00	
J2	0.00	301.32	50.47	0.00	
J3	0.08	298.99	50.63	0.00	
J4	0.07	297.43	50.47	0.00	
J5	0.00	296.79	50.45	0.00	
J6	0.30	296.68	50.73	0.00	
J7	0.10	300.07	50.70	0.00	
J8	0.05	298.13	50.56	0.00	
J9	0.10	296.55	50.97	0.00	
J11	0.17	296.38	50.93	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	296.27	50.58	0.00	
J13	0.00	295.10	49.95	0.00	
J14	0.00	294.92	49.85	0.00	
J15	0.00	294.96	50.20	0.00	
J16	0.00	294.97	50.06	0.00	
J17	0.22	294.20	49.54	0.00	
J19	166.96	290.42	46.04	0.00	
J20	0.29	291.03	47.03	0.00	
J21	0.15	291.50	47.79	0.00	
J22	0.15	291.85	48.22	0.00	
J23	0.00	292.00	48.33	0.00	
J24	0.15	292.00	48.13	0.00	
J25	0.13	292.00	48.13	0.00	
J26	0.18	292.00	48.20	0.00	
J27	0.00	292.00	48.20	0.00	
J28	0.05	292.00	48.20	0.00	
J29	0.04	292.36	48.48	0.00	
J30	0.09	292.60	48.58	0.00	
J31	0.05	293.16	48.82	0.00	
J32	0.13	294.35	49.30	0.00	
J33	0.00	298.01	52.36	0.00	
J34	0.00	294.66	49.58	0.00	
J35	0.00	291.70	48.11	0.00	
R1	-70.71	0.00	0.00	0.00	Reservoir
R2	-98.76	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	70.71	2.25	33.21	Open
P4	70.41	2.24	32.95	Open
P5	20.14	0.64	3.25	Open
P6	70.71	2.25	33.21	Open
P7	70.61	2.25	33.12	Open
P8	70.52	2.24	33.05	Open
P9	70.47	2.24	33.01	Open
P2	19.84	0.63	3.16	Open
P11	19.57	0.62	3.08	Open
P12	50.26	1.60	17.65	Open
P13	69.84	2.22	32.46	Open
P14	69.84	2.22	32.46	Open
P15	98.76	3.14	61.66	Open
P16	10.76	0.34	1.02	Open
P17	10.76	0.34	1.02	Open
P18	88.00	2.80	49.80	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	80.60	2.57	42.33	Open
P20	-38.88	1.24	10.97	Open
P21	41.72	1.33	12.50	Open
P22	126.66	4.03	97.75	Open
P23	-40.30	1.28	11.73	Open
P24	-40.60	1.29	11.88	Open
P25	-40.74	1.30	11.96	Open
P26	-40.74	1.30	11.96	Open
P27	-40.89	1.30	12.04	Open
P28	-41.41	1.32	12.33	Open
P29	-41.44	1.32	12.35	Open
P30	-41.53	1.32	12.40	Open
P31	41.59	1.32	12.43	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.74	0.63	3.13	Open
1	70.71	0.00	-302.05	Open Pump
2	98.76	0.00	-298.01	Open Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.05	50.75	0.00	
J2	0.00	301.32	50.47	0.00	
J3	0.08	298.99	50.63	0.00	
J4	0.07	297.43	50.47	0.00	
J5	0.00	296.79	50.45	0.00	
J6	0.30	296.68	50.73	0.00	
J7	0.10	300.07	50.70	0.00	
J8	0.05	298.13	50.56	0.00	
J9	0.10	296.55	50.97	0.00	
J11	0.17	296.38	50.93	0.00	
J12	0.00	296.27	50.58	0.00	
J13	0.00	295.10	49.95	0.00	
J14	0.00	294.92	49.85	0.00	
J15	0.00	294.96	50.20	0.00	
J16	0.00	294.97	50.06	0.00	
J17	0.22	294.20	49.54	0.00	
J19	166.96	290.42	46.04	0.00	
J20	0.29	291.03	47.03	0.00	
J21	0.15	291.50	47.79	0.00	
J22	0.15	291.85	48.22	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	292.00	48.33	0.00	
J24	0.15	292.00	48.13	0.00	
J25	0.13	292.00	48.13	0.00	
J26	0.18	292.00	48.20	0.00	
J27	0.00	292.00	48.20	0.00	
J28	0.05	292.00	48.20	0.00	
J29	0.04	292.36	48.48	0.00	
J30	0.09	292.60	48.58	0.00	
J31	0.05	293.16	48.82	0.00	
J32	0.13	294.35	49.30	0.00	
J33	0.00	298.01	52.36	0.00	
J34	0.00	294.66	49.58	0.00	
J35	0.00	291.70	48.11	0.00	
R1	-70.71	0.00	0.00	0.00	Reservoir
R2	-98.76	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	70.71	2.25	33.21	Open
P4	70.41	2.24	32.95	Open
P5	20.14	0.64	3.25	Open
P6	70.71	2.25	33.21	Open
P7	70.61	2.25	33.12	Open
P8	70.52	2.24	33.05	Open
P9	70.47	2.24	33.01	Open
P2	19.84	0.63	3.16	Open
P11	19.57	0.62	3.08	Open
P12	50.26	1.60	17.65	Open
P13	69.84	2.22	32.46	Open
P14	69.84	2.22	32.46	Open
P15	98.76	3.14	61.66	Open
P16	10.76	0.34	1.02	Open
P17	10.76	0.34	1.02	Open
P18	88.00	2.80	49.80	Open
P19	80.60	2.57	42.33	Open
P20	-38.88	1.24	10.97	Open
P21	41.72	1.33	12.50	Open
P22	126.66	4.03	97.75	Open
P23	-40.30	1.28	11.73	Open
P24	-40.60	1.29	11.88	Open
P25	-40.74	1.30	11.96	Open
P26	-40.74	1.30	11.96	Open
P27	-40.89	1.30	12.05	Open
P28	-41.41	1.32	12.33	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	-41.44	1.32	12.35	Open
P30	-41.53	1.32	12.40	Open
P31	41.59	1.32	12.43	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.74	0.63	3.13	Open
1	70.71	0.00	-302.05	Open Pump
2	98.76	0.00	-298.01	Open Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.05	50.75	0.00	
J2	0.00	301.32	50.47	0.00	
J3	0.08	298.99	50.63	0.00	
J4	0.07	297.43	50.47	0.00	
J5	0.00	296.79	50.45	0.00	
J6	0.30	296.68	50.73	0.00	
J7	0.10	300.07	50.70	0.00	
J8	0.05	298.13	50.56	0.00	
J9	0.10	296.55	50.97	0.00	
J11	0.17	296.38	50.93	0.00	
J12	0.00	296.27	50.58	0.00	
J13	0.00	295.10	49.95	0.00	
J14	0.00	294.92	49.85	0.00	
J15	0.00	294.96	50.20	0.00	
J16	0.00	294.97	50.06	0.00	
J17	0.22	294.20	49.54	0.00	
J19	166.96	290.42	46.04	0.00	
J20	0.29	291.03	47.03	0.00	
J21	0.15	291.50	47.79	0.00	
J22	0.15	291.85	48.22	0.00	
J23	0.00	292.00	48.33	0.00	
J24	0.15	292.00	48.13	0.00	
J25	0.13	292.00	48.13	0.00	
J26	0.18	292.00	48.20	0.00	
J27	0.00	292.00	48.20	0.00	
J28	0.05	292.00	48.20	0.00	
J29	0.04	292.36	48.48	0.00	
J30	0.09	292.60	48.58	0.00	
J31	0.05	293.16	48.82	0.00	
J32	0.13	294.35	49.30	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	298.01	52.36	0.00	
J34	0.00	294.66	49.58	0.00	
J35	0.00	291.70	48.11	0.00	
R1	-70.71	0.00	0.00	0.00	Reservoir
R2	-98.76	0.00	0.00	0.00	Reservoir

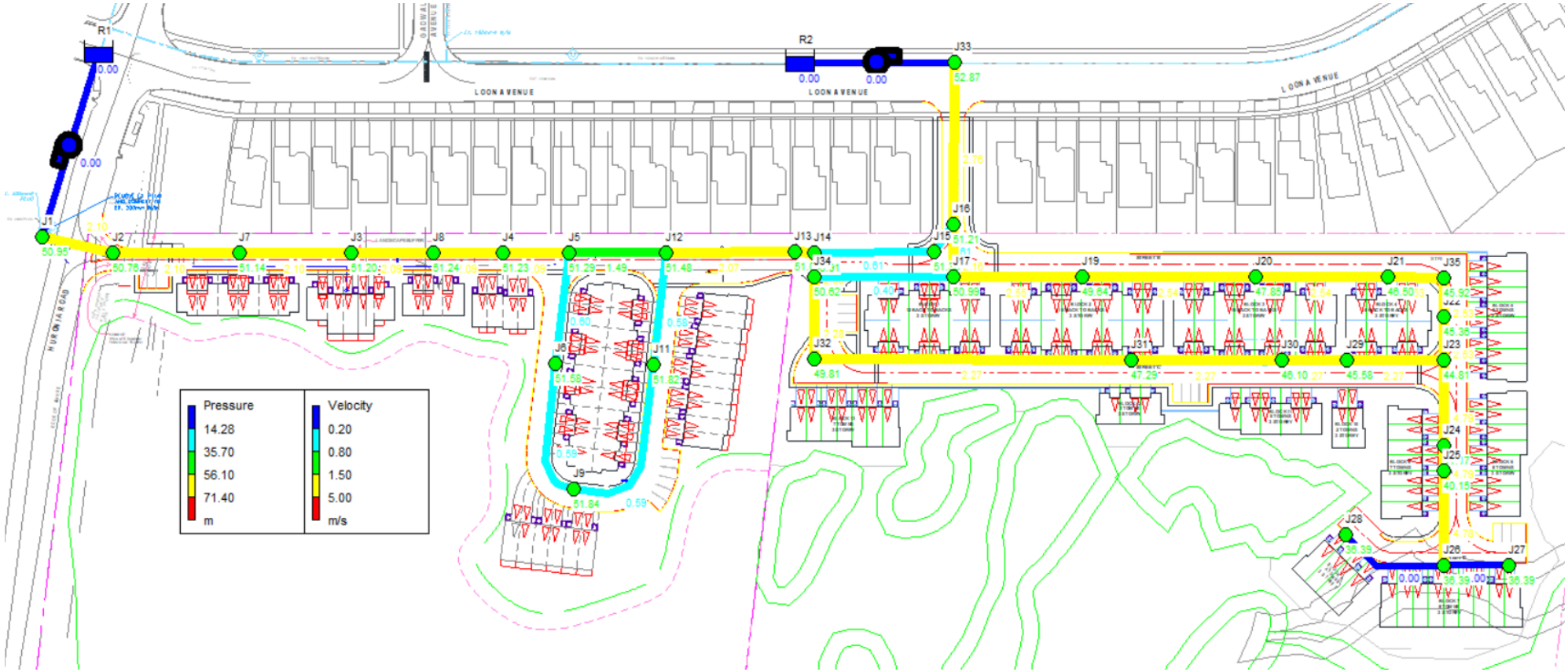
Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	70.71	2.25	33.21	Open
P4	70.41	2.24	32.95	Open
P5	20.14	0.64	3.25	Open
P6	70.71	2.25	33.21	Open
P7	70.61	2.25	33.12	Open
P8	70.52	2.24	33.05	Open
P9	70.47	2.24	33.01	Open
P2	19.84	0.63	3.16	Open
P11	19.57	0.62	3.08	Open
P12	50.26	1.60	17.65	Open
P13	69.84	2.22	32.46	Open
P14	69.84	2.22	32.46	Open
P15	98.76	3.14	61.66	Open
P16	10.76	0.34	1.02	Open
P17	10.76	0.34	1.02	Open
P18	88.00	2.80	49.80	Open
P19	80.60	2.57	42.33	Open
P20	-38.88	1.24	10.97	Open
P21	41.72	1.33	12.50	Open
P22	126.66	4.03	97.75	Open
P23	-40.30	1.28	11.73	Open
P24	-40.60	1.29	11.88	Open
P25	-40.74	1.30	11.96	Open
P26	-40.74	1.30	11.96	Open
P27	-40.89	1.30	12.05	Open
P28	-41.41	1.32	12.33	Open
P29	-41.44	1.32	12.35	Open
P30	-41.53	1.32	12.40	Open
P31	41.59	1.32	12.43	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.74	0.63	3.13	Open
1	70.71	0.00	-302.05	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	98.76	0.00	-298.01	Open Pump

Max Day + Fire Flow Demand Conditions at Block 7 (J26) Schematic



Project No: 21076
January 2022

Prepared by: JL

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*********************************************************************
*                          E P A N E T                              *
*                    Hydraulic and Water Quality                    *
*                    Analysis for Pipe Networks                     *
*                         Version 2.2                               *
*********************************************************************

Input File: 21076_Max Day + Fire @ Block 7.net
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Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	200
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	260.62	260.62	0.00
2	100.00	75.00	1.08	338.77	338.77	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	302.25	50.95	0.00
J2	0.00	301.61	50.76	0.00
J3	0.08	299.56	51.20	0.00
J4	0.07	298.19	51.23	0.00
J5	0.00	297.63	51.29	0.00
J6	0.30	297.53	51.58	0.00
J7	0.10	300.51	51.14	0.00
J8	0.05	298.81	51.24	0.00
J9	0.10	297.42	51.84	0.00
J11	0.17	297.27	51.82	0.00
J12	0.00	297.17	51.48	0.00
J13	0.00	296.15	51.00	0.00
J14	0.00	295.98	50.91	0.00
J15	0.00	296.09	51.33	0.00
J16	0.00	296.12	51.21	0.00
J17	0.22	295.65	50.99	0.00
J19	0.29	294.02	49.64	0.00
J20	0.29	291.85	47.85	0.00
J21	0.15	290.21	46.50	0.00
J22	0.15	288.99	45.36	0.00
J23	0.00	288.48	44.81	0.00
J24	0.15	285.04	41.17	0.00
J25	0.13	284.02	40.15	0.00
J26	150.18	280.19	36.39	0.00
J27	0.00	280.19	36.39	0.00
J28	0.05	280.19	36.39	0.00

J29	0.04	289.46	45.58	0.00	
J30	0.09	290.12	46.10	0.00	
J31	0.05	291.63	47.29	0.00	
J32	0.13	294.86	49.81	0.00	
J33	0.00	298.52	52.87	0.00	
J34	0.00	295.70	50.62	0.00	
J35	0.00	289.51	45.92	0.00	
R1	-65.97	0.00	0.00	0.00	Reservoir
R2	-86.83	0.00	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	65.97	2.10	29.21	Open
P4	65.67	2.09	28.96	Open
P5	18.80	0.60	2.86	Open
P6	65.97	2.10	29.21	Open
P7	65.87	2.10	29.13	Open
P8	65.79	2.09	29.06	Open
P9	65.74	2.09	29.02	Open
P2	18.50	0.59	2.77	Open
P11	18.23	0.58	2.70	Open
P12	46.87	1.49	15.51	Open
P13	65.10	2.07	28.50	Open
P14	65.10	2.07	28.50	Open
P15	86.83	2.76	48.58	Open
P16	19.01	0.61	2.92	Open
P17	19.01	0.61	2.92	Open
P18	67.82	2.16	30.74	Open
P19	84.11	2.68	45.80	Open
P20	-12.64	0.40	1.37	Open
P21	71.47	2.28	33.88	Open
P22	80.24	2.55	41.97	Open
P23	79.94	2.54	41.69	Open
P24	79.65	2.54	41.40	Open
P25	79.50	2.53	41.26	Open
P26	79.50	2.53	41.26	Open
P27	79.36	2.53	41.12	Open
P28	-71.16	2.27	33.60	Open
P29	-71.20	2.27	33.64	Open
P30	-71.29	2.27	33.72	Open
P31	71.34	2.27	33.77	Open
P32	150.51	4.79	134.56	Open
P33	150.37	4.79	134.32	Open
P34	150.24	4.78	134.11	Open

P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	18.40	0.59	2.75	Open
1	65.97	0.00	-302.25	Open Pump
2	86.83	0.00	-298.52	Open Pump

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Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.25	50.95	0.00	
J2	0.00	301.61	50.76	0.00	
J3	0.08	299.56	51.20	0.00	
J4	0.07	298.19	51.23	0.00	
J5	0.00	297.63	51.29	0.00	
J6	0.30	297.53	51.58	0.00	
J7	0.10	300.51	51.14	0.00	
J8	0.05	298.81	51.24	0.00	
J9	0.10	297.42	51.84	0.00	
J11	0.17	297.27	51.82	0.00	
J12	0.00	297.17	51.48	0.00	
J13	0.00	296.15	51.00	0.00	
J14	0.00	295.98	50.91	0.00	
J15	0.00	296.09	51.33	0.00	
J16	0.00	296.12	51.21	0.00	
J17	0.22	295.65	50.99	0.00	
J19	0.29	294.02	49.64	0.00	
J20	0.29	291.85	47.85	0.00	
J21	0.15	290.21	46.50	0.00	
J22	0.15	288.99	45.36	0.00	
J23	0.00	288.48	44.81	0.00	
J24	0.15	285.04	41.17	0.00	
J25	0.13	284.02	40.15	0.00	
J26	150.18	280.19	36.39	0.00	
J27	0.00	280.19	36.39	0.00	
J28	0.05	280.19	36.39	0.00	
J29	0.04	289.46	45.58	0.00	
J30	0.09	290.12	46.10	0.00	
J31	0.05	291.63	47.29	0.00	
J32	0.13	294.86	49.81	0.00	
J33	0.00	298.52	52.87	0.00	
J34	0.00	295.70	50.62	0.00	
J35	0.00	289.51	45.92	0.00	
R1	-65.97	0.00	0.00	0.00	Reservoir
R2	-86.83	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	65.97	2.10	29.21	Open
P4	65.67	2.09	28.96	Open
P5	18.80	0.60	2.86	Open
P6	65.97	2.10	29.21	Open
P7	65.87	2.10	29.13	Open
P8	65.79	2.09	29.06	Open

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Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P9	65.74	2.09	29.02	Open
P2	18.50	0.59	2.77	Open
P11	18.23	0.58	2.70	Open
P12	46.87	1.49	15.51	Open
P13	65.10	2.07	28.50	Open
P14	65.10	2.07	28.50	Open
P15	86.83	2.76	48.58	Open
P16	19.01	0.61	2.92	Open
P17	19.01	0.61	2.92	Open
P18	67.82	2.16	30.74	Open
P19	84.11	2.68	45.80	Open
P20	-12.64	0.40	1.37	Open
P21	71.47	2.28	33.88	Open
P22	80.24	2.55	41.97	Open
P23	79.94	2.54	41.69	Open
P24	79.65	2.54	41.40	Open
P25	79.50	2.53	41.26	Open
P26	79.50	2.53	41.26	Open
P27	79.36	2.53	41.12	Open
P28	-71.16	2.27	33.60	Open
P29	-71.20	2.27	33.64	Open
P30	-71.29	2.27	33.72	Open
P31	71.34	2.27	33.77	Open
P32	150.52	4.79	134.56	Open
P33	150.37	4.79	134.32	Open
P34	150.24	4.78	134.11	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	18.40	0.59	2.75	Open
1	65.97	0.00	-302.25	Open Pump
2	86.83	0.00	-298.52	Open Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.25	50.95	0.00	
J2	0.00	301.61	50.76	0.00	
J3	0.08	299.56	51.20	0.00	
J4	0.07	298.19	51.23	0.00	
J5	0.00	297.63	51.29	0.00	
J6	0.30	297.53	51.58	0.00	
J7	0.10	300.51	51.14	0.00	
J8	0.05	298.81	51.24	0.00	
J9	0.10	297.42	51.84	0.00	
J11	0.17	297.27	51.82	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	297.17	51.48	0.00	
J13	0.00	296.15	51.00	0.00	
J14	0.00	295.98	50.91	0.00	
J15	0.00	296.09	51.33	0.00	
J16	0.00	296.12	51.21	0.00	
J17	0.22	295.65	50.99	0.00	
J19	0.29	294.02	49.64	0.00	
J20	0.29	291.85	47.85	0.00	
J21	0.15	290.21	46.50	0.00	
J22	0.15	288.99	45.36	0.00	
J23	0.00	288.48	44.81	0.00	
J24	0.15	285.04	41.17	0.00	
J25	0.13	284.02	40.15	0.00	
J26	150.18	280.19	36.39	0.00	
J27	0.00	280.19	36.39	0.00	
J28	0.05	280.19	36.39	0.00	
J29	0.04	289.46	45.58	0.00	
J30	0.09	290.12	46.10	0.00	
J31	0.05	291.63	47.29	0.00	
J32	0.13	294.86	49.81	0.00	
J33	0.00	298.52	52.87	0.00	
J34	0.00	295.70	50.62	0.00	
J35	0.00	289.51	45.92	0.00	
R1	-65.97	0.00	0.00	0.00	Reservoir
R2	-86.83	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	65.97	2.10	29.21	Open
P4	65.67	2.09	28.96	Open
P5	18.80	0.60	2.86	Open
P6	65.97	2.10	29.21	Open
P7	65.87	2.10	29.13	Open
P8	65.79	2.09	29.06	Open
P9	65.74	2.09	29.02	Open
P2	18.50	0.59	2.77	Open
P11	18.23	0.58	2.70	Open
P12	46.87	1.49	15.51	Open
P13	65.10	2.07	28.50	Open
P14	65.10	2.07	28.50	Open
P15	86.83	2.76	48.58	Open
P16	19.01	0.61	2.92	Open
P17	19.01	0.61	2.92	Open
P18	67.82	2.16	30.74	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	84.11	2.68	45.80	Open
P20	-12.64	0.40	1.37	Open
P21	71.47	2.28	33.88	Open
P22	80.24	2.55	41.97	Open
P23	79.94	2.54	41.69	Open
P24	79.65	2.54	41.40	Open
P25	79.50	2.53	41.26	Open
P26	79.50	2.53	41.26	Open
P27	79.36	2.53	41.12	Open
P28	-71.16	2.27	33.60	Open
P29	-71.20	2.27	33.64	Open
P30	-71.29	2.27	33.72	Open
P31	71.34	2.27	33.77	Open
P32	150.51	4.79	134.56	Open
P33	150.37	4.79	134.32	Open
P34	150.24	4.78	134.11	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	18.40	0.59	2.75	Open
1	65.97	0.00	-302.25	Open Pump
2	86.83	0.00	-298.52	Open Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.25	50.95	0.00	
J2	0.00	301.61	50.76	0.00	
J3	0.08	299.56	51.20	0.00	
J4	0.07	298.19	51.23	0.00	
J5	0.00	297.63	51.29	0.00	
J6	0.30	297.53	51.58	0.00	
J7	0.10	300.51	51.14	0.00	
J8	0.05	298.81	51.24	0.00	
J9	0.10	297.42	51.84	0.00	
J11	0.17	297.27	51.82	0.00	
J12	0.00	297.17	51.48	0.00	
J13	0.00	296.15	51.00	0.00	
J14	0.00	295.98	50.91	0.00	
J15	0.00	296.09	51.33	0.00	
J16	0.00	296.12	51.21	0.00	
J17	0.22	295.65	50.99	0.00	
J19	0.29	294.02	49.64	0.00	
J20	0.29	291.85	47.85	0.00	
J21	0.15	290.21	46.50	0.00	
J22	0.15	288.99	45.36	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	288.48	44.81	0.00	
J24	0.15	285.04	41.17	0.00	
J25	0.13	284.02	40.15	0.00	
J26	150.18	280.19	36.39	0.00	
J27	0.00	280.19	36.39	0.00	
J28	0.05	280.19	36.39	0.00	
J29	0.04	289.46	45.58	0.00	
J30	0.09	290.12	46.10	0.00	
J31	0.05	291.63	47.29	0.00	
J32	0.13	294.86	49.81	0.00	
J33	0.00	298.52	52.87	0.00	
J34	0.00	295.70	50.62	0.00	
J35	0.00	289.51	45.92	0.00	
R1	-65.97	0.00	0.00	0.00	Reservoir
R2	-86.83	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	65.97	2.10	29.21	Open
P4	65.67	2.09	28.96	Open
P5	18.80	0.60	2.86	Open
P6	65.97	2.10	29.21	Open
P7	65.87	2.10	29.13	Open
P8	65.79	2.09	29.06	Open
P9	65.74	2.09	29.02	Open
P2	18.50	0.59	2.77	Open
P11	18.23	0.58	2.70	Open
P12	46.87	1.49	15.51	Open
P13	65.10	2.07	28.50	Open
P14	65.10	2.07	28.50	Open
P15	86.83	2.76	48.58	Open
P16	19.01	0.61	2.92	Open
P17	19.01	0.61	2.92	Open
P18	67.82	2.16	30.74	Open
P19	84.11	2.68	45.80	Open
P20	-12.64	0.40	1.37	Open
P21	71.47	2.28	33.88	Open
P22	80.24	2.55	41.97	Open
P23	79.94	2.54	41.69	Open
P24	79.65	2.54	41.40	Open
P25	79.50	2.53	41.26	Open
P26	79.50	2.53	41.26	Open
P27	79.36	2.53	41.12	Open
P28	-71.16	2.27	33.60	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	-71.20	2.27	33.64	Open
P30	-71.29	2.27	33.72	Open
P31	71.34	2.27	33.77	Open
P32	150.51	4.79	134.57	Open
P33	150.37	4.79	134.32	Open
P34	150.24	4.78	134.11	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	18.40	0.59	2.75	Open
1	65.97	0.00	-302.25	Open Pump
2	86.83	0.00	-298.52	Open Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.25	50.95	0.00	
J2	0.00	301.61	50.76	0.00	
J3	0.08	299.56	51.20	0.00	
J4	0.07	298.19	51.23	0.00	
J5	0.00	297.63	51.29	0.00	
J6	0.30	297.53	51.58	0.00	
J7	0.10	300.51	51.14	0.00	
J8	0.05	298.81	51.24	0.00	
J9	0.10	297.42	51.84	0.00	
J11	0.17	297.27	51.82	0.00	
J12	0.00	297.17	51.48	0.00	
J13	0.00	296.15	51.00	0.00	
J14	0.00	295.98	50.91	0.00	
J15	0.00	296.09	51.33	0.00	
J16	0.00	296.12	51.21	0.00	
J17	0.22	295.65	50.99	0.00	
J19	0.29	294.02	49.64	0.00	
J20	0.29	291.85	47.85	0.00	
J21	0.15	290.21	46.50	0.00	
J22	0.15	288.99	45.36	0.00	
J23	0.00	288.48	44.81	0.00	
J24	0.15	285.04	41.17	0.00	
J25	0.13	284.02	40.15	0.00	
J26	150.18	280.19	36.39	0.00	
J27	0.00	280.19	36.39	0.00	
J28	0.05	280.19	36.39	0.00	
J29	0.04	289.46	45.58	0.00	
J30	0.09	290.12	46.10	0.00	
J31	0.05	291.63	47.29	0.00	
J32	0.13	294.86	49.81	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	298.52	52.87	0.00	
J34	0.00	295.70	50.62	0.00	
J35	0.00	289.51	45.92	0.00	
R1	-65.97	0.00	0.00	0.00	Reservoir
R2	-86.83	0.00	0.00	0.00	Reservoir

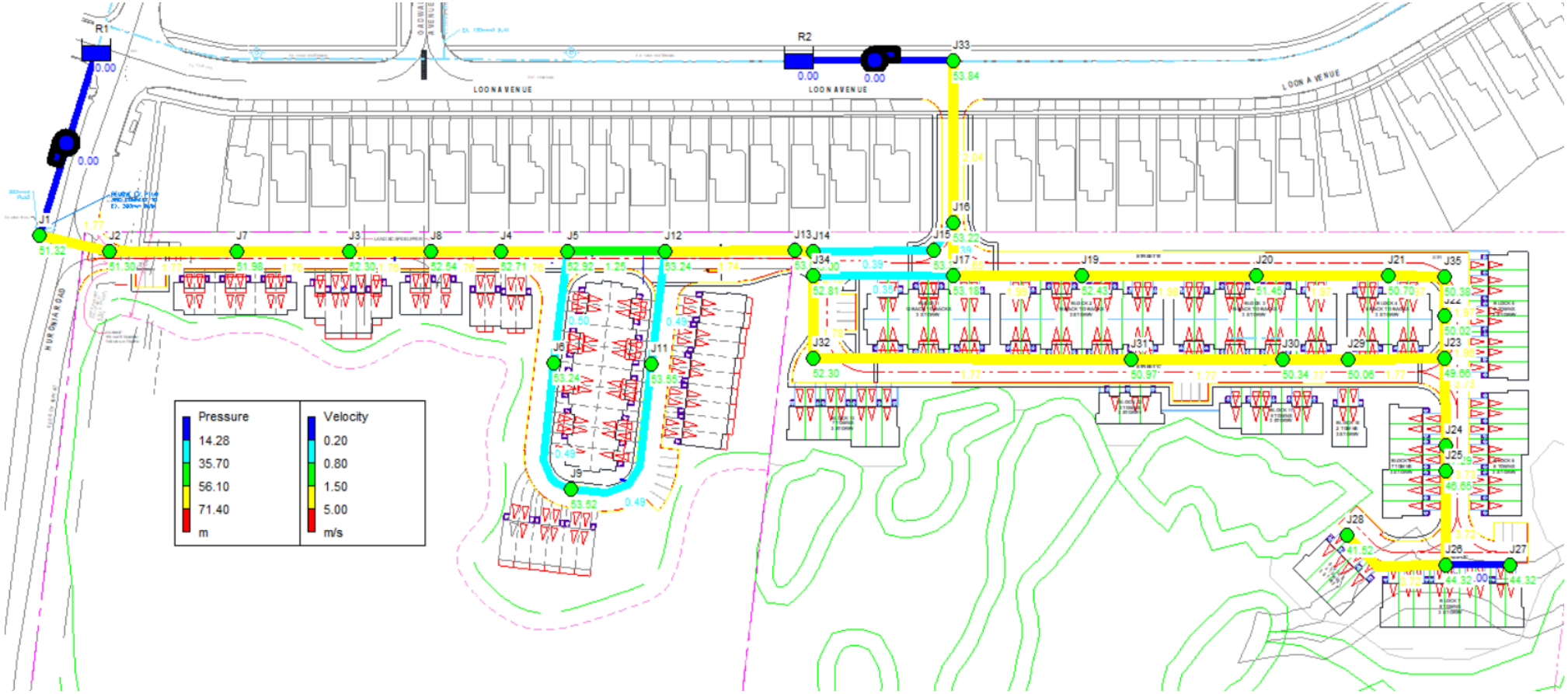
Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	65.97	2.10	29.21	Open
P4	65.67	2.09	28.96	Open
P5	18.80	0.60	2.86	Open
P6	65.97	2.10	29.21	Open
P7	65.87	2.10	29.13	Open
P8	65.79	2.09	29.06	Open
P9	65.74	2.09	29.02	Open
P2	18.50	0.59	2.77	Open
P11	18.23	0.58	2.70	Open
P12	46.87	1.49	15.51	Open
P13	65.10	2.07	28.50	Open
P14	65.10	2.07	28.50	Open
P15	86.83	2.76	48.58	Open
P16	19.01	0.61	2.92	Open
P17	19.01	0.61	2.92	Open
P18	67.82	2.16	30.74	Open
P19	84.11	2.68	45.80	Open
P20	-12.64	0.40	1.37	Open
P21	71.47	2.28	33.88	Open
P22	80.24	2.55	41.97	Open
P23	79.94	2.54	41.69	Open
P24	79.65	2.54	41.40	Open
P25	79.50	2.53	41.26	Open
P26	79.50	2.53	41.26	Open
P27	79.36	2.53	41.12	Open
P28	-71.16	2.27	33.60	Open
P29	-71.20	2.27	33.64	Open
P30	-71.29	2.27	33.72	Open
P31	71.34	2.27	33.77	Open
P32	150.51	4.79	134.57	Open
P33	150.37	4.79	134.32	Open
P34	150.24	4.78	134.11	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	18.40	0.59	2.75	Open
1	65.97	0.00	-302.25	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	86.83	0.00	-298.52	Open Pump

Max Day + Fire Flow Demand Conditions at Block 8 (J28) Schematic



Project No: 21076
January 2022

Prepared by: JL

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*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                           Version 2.2                                 *
*************************************************************************

Input File: 21076_Max Day + Fire @ Block 8.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	200
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	219.62	219.62	0.00
2	100.00	75.00	1.09	250.29	250.29	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	302.62	51.32	0.00
J2	0.00	302.15	51.30	0.00
J3	0.08	300.66	52.30	0.00
J4	0.07	299.67	52.71	0.00
J5	0.00	299.26	52.92	0.00
J6	0.30	299.19	53.24	0.00
J7	0.10	301.35	51.98	0.00
J8	0.05	300.11	52.54	0.00
J9	0.10	299.10	53.52	0.00
J11	0.17	299.00	53.55	0.00
J12	0.00	298.93	53.24	0.00
J13	0.00	298.19	53.04	0.00
J14	0.00	298.07	53.00	0.00
J15	0.00	298.11	53.35	0.00
J16	0.00	298.13	53.22	0.00
J17	0.22	297.84	53.18	0.00
J19	0.29	296.81	52.43	0.00
J20	0.29	295.45	51.45	0.00
J21	0.15	294.41	50.70	0.00
J22	0.15	293.65	50.02	0.00
J23	0.00	293.33	49.66	0.00
J24	0.15	291.16	47.29	0.00
J25	0.13	290.52	46.65	0.00
J26	0.18	288.12	44.32	0.00
J27	0.00	288.12	44.32	0.00
J28	116.72	285.32	41.52	0.00

J29	0.04	293.94	50.06	0.00	
J30	0.09	294.36	50.34	0.00	
J31	0.05	295.31	50.97	0.00	
J32	0.13	297.35	52.30	0.00	
J33	0.00	299.49	53.84	0.00	
J34	0.00	297.89	52.81	0.00	
J35	0.00	293.97	50.38	0.00	
R1	-55.53	0.00	0.00	0.00	Reservoir
R2	-63.94	0.00	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	55.53	1.77	21.23	Open
P4	55.23	1.76	21.01	Open
P5	15.85	0.50	2.08	Open
P6	55.53	1.77	21.23	Open
P7	55.43	1.76	21.16	Open
P8	55.34	1.76	21.10	Open
P9	55.29	1.76	21.06	Open
P2	15.55	0.49	2.01	Open
P11	15.28	0.49	1.95	Open
P12	39.38	1.25	11.23	Open
P13	54.66	1.74	20.61	Open
P14	54.66	1.74	20.61	Open
P15	63.94	2.04	27.57	Open
P16	12.15	0.39	1.27	Open
P17	12.15	0.39	1.27	Open
P18	51.79	1.65	18.66	Open
P19	66.81	2.13	29.90	Open
P20	-11.03	0.35	1.06	Open
P21	55.77	1.78	21.40	Open
P22	62.60	1.99	26.51	Open
P23	62.31	1.98	26.28	Open
P24	62.01	1.97	26.05	Open
P25	61.87	1.97	25.93	Open
P26	61.87	1.97	25.93	Open
P27	61.72	1.96	25.82	Open
P28	-55.46	1.77	21.18	Open
P29	-55.50	1.77	21.21	Open
P30	-55.59	1.77	21.27	Open
P31	55.65	1.77	21.31	Open
P32	117.18	3.73	84.64	Open
P33	117.03	3.73	84.45	Open
P34	116.91	3.72	84.27	Open

P35	0.00	0.00	0.00	Open
P36	116.72	3.72	84.03	Open
P3	15.45	0.49	1.99	Open
1	55.53	0.00	-302.62	Open Pump
2	63.94	0.00	-299.49	Open Pump

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Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.62	51.32	0.00	
J2	0.00	302.15	51.30	0.00	
J3	0.08	300.66	52.30	0.00	
J4	0.07	299.67	52.71	0.00	
J5	0.00	299.26	52.92	0.00	
J6	0.30	299.19	53.24	0.00	
J7	0.10	301.35	51.98	0.00	
J8	0.05	300.11	52.54	0.00	
J9	0.10	299.10	53.52	0.00	
J11	0.17	299.00	53.55	0.00	
J12	0.00	298.93	53.24	0.00	
J13	0.00	298.19	53.04	0.00	
J14	0.00	298.07	53.00	0.00	
J15	0.00	298.11	53.35	0.00	
J16	0.00	298.13	53.22	0.00	
J17	0.22	297.84	53.18	0.00	
J19	0.29	296.81	52.43	0.00	
J20	0.29	295.45	51.45	0.00	
J21	0.15	294.41	50.70	0.00	
J22	0.15	293.65	50.02	0.00	
J23	0.00	293.33	49.66	0.00	
J24	0.15	291.16	47.29	0.00	
J25	0.13	290.52	46.65	0.00	
J26	0.18	288.12	44.32	0.00	
J27	0.00	288.12	44.32	0.00	
J28	116.72	285.32	41.52	0.00	
J29	0.04	293.94	50.06	0.00	
J30	0.09	294.36	50.34	0.00	
J31	0.05	295.31	50.97	0.00	
J32	0.13	297.35	52.30	0.00	
J33	0.00	299.49	53.84	0.00	
J34	0.00	297.89	52.81	0.00	
J35	0.00	293.97	50.38	0.00	
R1	-55.53	0.00	0.00	0.00	Reservoir
R2	-63.94	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	55.53	1.77	21.23	Open
P4	55.23	1.76	21.01	Open
P5	15.85	0.50	2.08	Open
P6	55.53	1.77	21.23	Open
P7	55.43	1.76	21.16	Open
P8	55.34	1.76	21.10	Open

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Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P9	55.29	1.76	21.06	Open
P2	15.55	0.49	2.01	Open
P11	15.28	0.49	1.95	Open
P12	39.38	1.25	11.23	Open
P13	54.66	1.74	20.61	Open
P14	54.66	1.74	20.61	Open
P15	63.94	2.04	27.57	Open
P16	12.15	0.39	1.27	Open
P17	12.15	0.39	1.27	Open
P18	51.79	1.65	18.66	Open
P19	66.81	2.13	29.90	Open
P20	-11.03	0.35	1.06	Open
P21	55.77	1.78	21.40	Open
P22	62.60	1.99	26.51	Open
P23	62.31	1.98	26.28	Open
P24	62.01	1.97	26.05	Open
P25	61.87	1.97	25.93	Open
P26	61.87	1.97	25.93	Open
P27	61.72	1.96	25.82	Open
P28	-55.46	1.77	21.18	Open
P29	-55.50	1.77	21.21	Open
P30	-55.59	1.77	21.27	Open
P31	55.65	1.77	21.31	Open
P32	117.18	3.73	84.64	Open
P33	117.03	3.73	84.45	Open
P34	116.91	3.72	84.27	Open
P35	0.00	0.00	0.00	Open
P36	116.72	3.72	84.03	Open
P3	15.45	0.49	1.99	Open
1	55.53	0.00	-302.62	Open Pump
2	63.94	0.00	-299.49	Open Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.62	51.32	0.00	
J2	0.00	302.15	51.30	0.00	
J3	0.08	300.66	52.30	0.00	
J4	0.07	299.67	52.71	0.00	
J5	0.00	299.26	52.92	0.00	
J6	0.30	299.19	53.24	0.00	
J7	0.10	301.35	51.98	0.00	
J8	0.05	300.11	52.54	0.00	
J9	0.10	299.10	53.52	0.00	
J11	0.17	299.00	53.55	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	298.93	53.24	0.00	
J13	0.00	298.19	53.04	0.00	
J14	0.00	298.07	53.00	0.00	
J15	0.00	298.11	53.35	0.00	
J16	0.00	298.13	53.22	0.00	
J17	0.22	297.84	53.18	0.00	
J19	0.29	296.81	52.43	0.00	
J20	0.29	295.45	51.45	0.00	
J21	0.15	294.41	50.70	0.00	
J22	0.15	293.65	50.02	0.00	
J23	0.00	293.33	49.66	0.00	
J24	0.15	291.16	47.29	0.00	
J25	0.13	290.52	46.65	0.00	
J26	0.18	288.12	44.32	0.00	
J27	0.00	288.12	44.32	0.00	
J28	116.72	285.32	41.52	0.00	
J29	0.04	293.94	50.06	0.00	
J30	0.09	294.36	50.34	0.00	
J31	0.05	295.31	50.97	0.00	
J32	0.13	297.35	52.30	0.00	
J33	0.00	299.49	53.84	0.00	
J34	0.00	297.88	52.80	0.00	
J35	0.00	293.97	50.38	0.00	
R1	-55.53	0.00	0.00	0.00	Reservoir
R2	-63.94	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	55.53	1.77	21.23	Open
P4	55.23	1.76	21.01	Open
P5	15.85	0.50	2.08	Open
P6	55.53	1.77	21.23	Open
P7	55.43	1.76	21.16	Open
P8	55.34	1.76	21.10	Open
P9	55.29	1.76	21.06	Open
P2	15.55	0.49	2.01	Open
P11	15.28	0.49	1.95	Open
P12	39.38	1.25	11.23	Open
P13	54.66	1.74	20.61	Open
P14	54.66	1.74	20.61	Open
P15	63.94	2.04	27.57	Open
P16	12.15	0.39	1.27	Open
P17	12.15	0.39	1.27	Open
P18	51.79	1.65	18.66	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	66.81	2.13	29.90	Open
P20	-11.03	0.35	1.06	Open
P21	55.77	1.78	21.40	Open
P22	62.60	1.99	26.51	Open
P23	62.31	1.98	26.28	Open
P24	62.01	1.97	26.05	Open
P25	61.87	1.97	25.93	Open
P26	61.87	1.97	25.93	Open
P27	61.72	1.96	25.82	Open
P28	-55.46	1.77	21.18	Open
P29	-55.50	1.77	21.21	Open
P30	-55.59	1.77	21.27	Open
P31	55.65	1.77	21.31	Open
P32	117.18	3.73	84.64	Open
P33	117.04	3.73	84.45	Open
P34	116.91	3.72	84.27	Open
P35	0.00	0.00	0.00	Open
P36	116.72	3.72	84.03	Open
P3	15.45	0.49	1.99	Open
1	55.53	0.00	-302.62	Open Pump
2	63.94	0.00	-299.49	Open Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.62	51.32	0.00	
J2	0.00	302.15	51.30	0.00	
J3	0.08	300.66	52.30	0.00	
J4	0.07	299.67	52.71	0.00	
J5	0.00	299.26	52.92	0.00	
J6	0.30	299.19	53.24	0.00	
J7	0.10	301.35	51.98	0.00	
J8	0.05	300.11	52.54	0.00	
J9	0.10	299.10	53.52	0.00	
J11	0.17	299.00	53.55	0.00	
J12	0.00	298.93	53.24	0.00	
J13	0.00	298.19	53.04	0.00	
J14	0.00	298.07	53.00	0.00	
J15	0.00	298.11	53.35	0.00	
J16	0.00	298.13	53.22	0.00	
J17	0.22	297.84	53.18	0.00	
J19	0.29	296.81	52.43	0.00	
J20	0.29	295.45	51.45	0.00	
J21	0.15	294.41	50.70	0.00	
J22	0.15	293.65	50.02	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	293.33	49.66	0.00	
J24	0.15	291.16	47.29	0.00	
J25	0.13	290.52	46.65	0.00	
J26	0.18	288.12	44.32	0.00	
J27	0.00	288.12	44.32	0.00	
J28	116.72	285.32	41.52	0.00	
J29	0.04	293.94	50.06	0.00	
J30	0.09	294.36	50.34	0.00	
J31	0.05	295.31	50.97	0.00	
J32	0.13	297.35	52.30	0.00	
J33	0.00	299.49	53.84	0.00	
J34	0.00	297.89	52.81	0.00	
J35	0.00	293.97	50.38	0.00	
R1	-55.53	0.00	0.00	0.00	Reservoir
R2	-63.94	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	55.53	1.77	21.23	Open
P4	55.23	1.76	21.01	Open
P5	15.85	0.50	2.08	Open
P6	55.53	1.77	21.23	Open
P7	55.43	1.76	21.16	Open
P8	55.34	1.76	21.10	Open
P9	55.29	1.76	21.06	Open
P2	15.55	0.49	2.01	Open
P11	15.28	0.49	1.95	Open
P12	39.38	1.25	11.23	Open
P13	54.66	1.74	20.61	Open
P14	54.66	1.74	20.61	Open
P15	63.94	2.04	27.57	Open
P16	12.15	0.39	1.27	Open
P17	12.15	0.39	1.27	Open
P18	51.79	1.65	18.66	Open
P19	66.81	2.13	29.90	Open
P20	-11.03	0.35	1.06	Open
P21	55.77	1.78	21.40	Open
P22	62.60	1.99	26.51	Open
P23	62.31	1.98	26.28	Open
P24	62.01	1.97	26.05	Open
P25	61.87	1.97	25.93	Open
P26	61.87	1.97	25.93	Open
P27	61.72	1.96	25.82	Open
P28	-55.46	1.77	21.18	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	-55.50	1.77	21.21	Open
P30	-55.59	1.77	21.27	Open
P31	55.65	1.77	21.31	Open
P32	117.18	3.73	84.64	Open
P33	117.03	3.73	84.45	Open
P34	116.91	3.72	84.27	Open
P35	0.00	0.00	0.00	Open
P36	116.72	3.72	84.03	Open
P3	15.45	0.49	1.99	Open
1	55.53	0.00	-302.62	Open Pump
2	63.94	0.00	-299.49	Open Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.62	51.32	0.00	
J2	0.00	302.15	51.30	0.00	
J3	0.08	300.66	52.30	0.00	
J4	0.07	299.67	52.71	0.00	
J5	0.00	299.26	52.92	0.00	
J6	0.30	299.19	53.24	0.00	
J7	0.10	301.35	51.98	0.00	
J8	0.05	300.11	52.54	0.00	
J9	0.10	299.10	53.52	0.00	
J11	0.17	299.00	53.55	0.00	
J12	0.00	298.93	53.24	0.00	
J13	0.00	298.19	53.04	0.00	
J14	0.00	298.07	53.00	0.00	
J15	0.00	298.11	53.35	0.00	
J16	0.00	298.13	53.22	0.00	
J17	0.22	297.84	53.18	0.00	
J19	0.29	296.81	52.43	0.00	
J20	0.29	295.45	51.45	0.00	
J21	0.15	294.41	50.70	0.00	
J22	0.15	293.65	50.02	0.00	
J23	0.00	293.33	49.66	0.00	
J24	0.15	291.16	47.29	0.00	
J25	0.13	290.52	46.65	0.00	
J26	0.18	288.12	44.32	0.00	
J27	0.00	288.12	44.32	0.00	
J28	116.72	285.32	41.52	0.00	
J29	0.04	293.94	50.06	0.00	
J30	0.09	294.36	50.34	0.00	
J31	0.05	295.31	50.97	0.00	
J32	0.13	297.35	52.30	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	299.49	53.84	0.00	
J34	0.00	297.88	52.80	0.00	
J35	0.00	293.97	50.38	0.00	
R1	-55.53	0.00	0.00	0.00	Reservoir
R2	-63.94	0.00	0.00	0.00	Reservoir

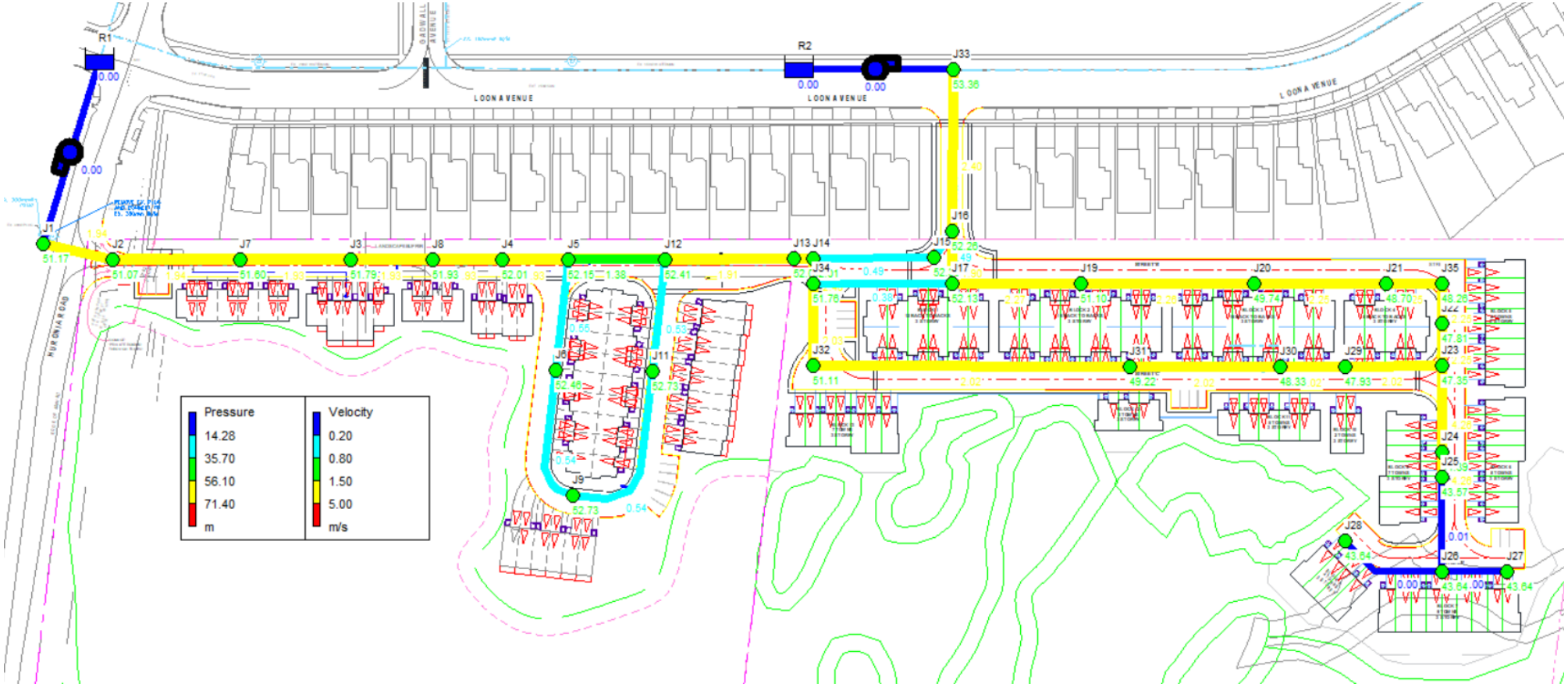
Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	55.53	1.77	21.23	Open
P4	55.23	1.76	21.01	Open
P5	15.85	0.50	2.08	Open
P6	55.53	1.77	21.23	Open
P7	55.43	1.76	21.16	Open
P8	55.34	1.76	21.10	Open
P9	55.29	1.76	21.06	Open
P2	15.55	0.49	2.01	Open
P11	15.28	0.49	1.95	Open
P12	39.38	1.25	11.23	Open
P13	54.66	1.74	20.61	Open
P14	54.66	1.74	20.61	Open
P15	63.94	2.04	27.57	Open
P16	12.15	0.39	1.27	Open
P17	12.15	0.39	1.27	Open
P18	51.79	1.65	18.66	Open
P19	66.81	2.13	29.90	Open
P20	-11.03	0.35	1.06	Open
P21	55.77	1.78	21.40	Open
P22	62.60	1.99	26.51	Open
P23	62.31	1.98	26.28	Open
P24	62.01	1.97	26.05	Open
P25	61.87	1.97	25.93	Open
P26	61.87	1.97	25.93	Open
P27	61.72	1.96	25.82	Open
P28	-55.46	1.77	21.18	Open
P29	-55.50	1.77	21.21	Open
P30	-55.59	1.77	21.27	Open
P31	55.65	1.77	21.31	Open
P32	117.18	3.73	84.64	Open
P33	117.04	3.73	84.45	Open
P34	116.91	3.72	84.27	Open
P35	0.00	0.00	0.00	Open
P36	116.72	3.72	84.03	Open
P3	15.45	0.49	1.99	Open
1	55.53	0.00	-302.62	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	63.94	0.00	-299.49	Open Pump

Max Day + Fire Flow Demand Conditions at Block 9 (J25) Schematic



Project No: 21076
January 2022

Prepared by: JL

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*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.2                                  *
*************************************************************************

Input File: 21076_Max Day + Fire @ Block 9.net
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Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	200
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	240.64	240.64	0.00
2	100.00	75.00	1.09	294.14	294.14	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	302.47	51.17	0.00
J2	0.00	301.92	51.07	0.00
J3	0.08	300.15	51.79	0.00
J4	0.07	298.97	52.01	0.00
J5	0.00	298.49	52.15	0.00
J6	0.30	298.41	52.46	0.00
J7	0.10	300.97	51.60	0.00
J8	0.05	299.50	51.93	0.00
J9	0.10	298.31	52.73	0.00
J11	0.17	298.18	52.73	0.00
J12	0.00	298.10	52.41	0.00
J13	0.00	297.21	52.06	0.00
J14	0.00	297.08	52.01	0.00
J15	0.00	297.15	52.39	0.00
J16	0.00	297.17	52.26	0.00
J17	0.22	296.79	52.13	0.00
J19	0.29	295.48	51.10	0.00
J20	0.29	293.74	49.74	0.00
J21	0.15	292.41	48.70	0.00
J22	0.15	291.44	47.81	0.00
J23	0.00	291.02	47.35	0.00
J24	0.15	288.26	44.39	0.00
J25	133.46	287.44	43.57	0.00
J26	0.18	287.44	43.64	0.00
J27	0.00	287.44	43.64	0.00
J28	0.05	287.44	43.64	0.00

J29	0.04	291.81	47.93	0.00	
J30	0.09	292.35	48.33	0.00	
J31	0.05	293.56	49.22	0.00	
J32	0.13	296.16	51.11	0.00	
J33	0.00	299.01	53.36	0.00	
J34	0.00	296.84	51.76	0.00	
J35	0.00	291.85	48.26	0.00	
R1	-60.87	0.00	0.00	0.00	Reservoir
R2	-75.27	0.00	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	60.87	1.94	25.16	Open
P4	60.57	1.93	24.93	Open
P5	17.36	0.55	2.47	Open
P6	60.87	1.94	25.16	Open
P7	60.77	1.93	25.09	Open
P8	60.69	1.93	25.02	Open
P9	60.64	1.93	24.98	Open
P2	17.06	0.54	2.39	Open
P11	16.79	0.53	2.32	Open
P12	43.21	1.38	13.34	Open
P13	60.00	1.91	24.50	Open
P14	60.00	1.91	24.50	Open
P15	75.27	2.40	37.28	Open
P16	15.52	0.49	2.00	Open
P17	15.52	0.49	2.00	Open
P18	59.75	1.90	24.31	Open
P19	75.52	2.40	37.52	Open
P20	-11.89	0.38	1.22	Open
P21	63.62	2.03	27.31	Open
P22	71.42	2.27	33.83	Open
P23	71.12	2.26	33.57	Open
P24	70.83	2.25	33.32	Open
P25	70.68	2.25	33.19	Open
P26	70.68	2.25	33.19	Open
P27	70.54	2.25	33.06	Open
P28	-63.31	2.02	27.06	Open
P29	-63.35	2.02	27.09	Open
P30	-63.44	2.02	27.17	Open
P31	63.50	2.02	27.21	Open
P32	133.85	4.26	108.28	Open
P33	133.70	4.26	108.06	Open
P34	0.24	0.01	0.00	Open

P35	0.00	0.00	0.00	Open	
P36	0.05	0.00	0.00	Open	
P3	16.96	0.54	2.36	Open	
1	60.87	0.00	-302.47	Open	Pump
2	75.27	0.00	-299.01	Open	Pump

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Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.47	51.17	0.00	
J2	0.00	301.92	51.07	0.00	
J3	0.08	300.15	51.79	0.00	
J4	0.07	298.97	52.01	0.00	
J5	0.00	298.49	52.15	0.00	
J6	0.30	298.41	52.46	0.00	
J7	0.10	300.97	51.60	0.00	
J8	0.05	299.50	51.93	0.00	
J9	0.10	298.31	52.73	0.00	
J11	0.17	298.18	52.73	0.00	
J12	0.00	298.10	52.41	0.00	
J13	0.00	297.21	52.06	0.00	
J14	0.00	297.08	52.01	0.00	
J15	0.00	297.15	52.39	0.00	
J16	0.00	297.17	52.26	0.00	
J17	0.22	296.79	52.13	0.00	
J19	0.29	295.48	51.10	0.00	
J20	0.29	293.74	49.74	0.00	
J21	0.15	292.41	48.70	0.00	
J22	0.15	291.44	47.81	0.00	
J23	0.00	291.02	47.35	0.00	
J24	0.15	288.26	44.39	0.00	
J25	133.46	287.44	43.57	0.00	
J26	0.18	287.44	43.64	0.00	
J27	0.00	287.44	43.64	0.00	
J28	0.05	287.44	43.64	0.00	
J29	0.04	291.81	47.93	0.00	
J30	0.09	292.35	48.33	0.00	
J31	0.05	293.56	49.22	0.00	
J32	0.13	296.16	51.11	0.00	
J33	0.00	299.01	53.36	0.00	
J34	0.00	296.84	51.76	0.00	
J35	0.00	291.85	48.26	0.00	
R1	-60.87	0.00	0.00	0.00	Reservoir
R2	-75.27	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	60.87	1.94	25.16	Open
P4	60.57	1.93	24.93	Open
P5	17.36	0.55	2.47	Open
P6	60.87	1.94	25.16	Open
P7	60.77	1.93	25.09	Open
P8	60.69	1.93	25.02	Open

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Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P9	60.64	1.93	24.98	Open
P2	17.06	0.54	2.39	Open
P11	16.79	0.53	2.32	Open
P12	43.21	1.38	13.34	Open
P13	60.00	1.91	24.50	Open
P14	60.00	1.91	24.50	Open
P15	75.27	2.40	37.28	Open
P16	15.52	0.49	2.00	Open
P17	15.52	0.49	2.00	Open
P18	59.75	1.90	24.31	Open
P19	75.52	2.40	37.52	Open
P20	-11.89	0.38	1.22	Open
P21	63.62	2.03	27.31	Open
P22	71.42	2.27	33.83	Open
P23	71.12	2.26	33.57	Open
P24	70.83	2.25	33.32	Open
P25	70.68	2.25	33.19	Open
P26	70.68	2.25	33.19	Open
P27	70.54	2.25	33.06	Open
P28	-63.31	2.02	27.06	Open
P29	-63.35	2.02	27.09	Open
P30	-63.44	2.02	27.17	Open
P31	63.50	2.02	27.21	Open
P32	133.85	4.26	108.28	Open
P33	133.70	4.26	108.06	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	16.96	0.54	2.36	Open
1	60.87	0.00	-302.47	Open Pump
2	75.27	0.00	-299.01	Open Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.47	51.17	0.00	
J2	0.00	301.92	51.07	0.00	
J3	0.08	300.15	51.79	0.00	
J4	0.07	298.97	52.01	0.00	
J5	0.00	298.49	52.15	0.00	
J6	0.30	298.41	52.46	0.00	
J7	0.10	300.97	51.60	0.00	
J8	0.05	299.50	51.93	0.00	
J9	0.10	298.31	52.73	0.00	
J11	0.17	298.18	52.73	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	298.10	52.41	0.00	
J13	0.00	297.21	52.06	0.00	
J14	0.00	297.08	52.01	0.00	
J15	0.00	297.15	52.39	0.00	
J16	0.00	297.17	52.26	0.00	
J17	0.22	296.79	52.13	0.00	
J19	0.29	295.48	51.10	0.00	
J20	0.29	293.74	49.74	0.00	
J21	0.15	292.41	48.70	0.00	
J22	0.15	291.44	47.81	0.00	
J23	0.00	291.02	47.35	0.00	
J24	0.15	288.26	44.39	0.00	
J25	133.46	287.44	43.57	0.00	
J26	0.18	287.44	43.64	0.00	
J27	0.00	287.44	43.64	0.00	
J28	0.05	287.44	43.64	0.00	
J29	0.04	291.81	47.93	0.00	
J30	0.09	292.35	48.33	0.00	
J31	0.05	293.56	49.22	0.00	
J32	0.13	296.16	51.11	0.00	
J33	0.00	299.01	53.36	0.00	
J34	0.00	296.84	51.76	0.00	
J35	0.00	291.85	48.26	0.00	
R1	-60.87	0.00	0.00	0.00	Reservoir
R2	-75.27	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	60.87	1.94	25.16	Open
P4	60.57	1.93	24.93	Open
P5	17.36	0.55	2.47	Open
P6	60.87	1.94	25.16	Open
P7	60.77	1.93	25.09	Open
P8	60.69	1.93	25.02	Open
P9	60.64	1.93	24.98	Open
P2	17.06	0.54	2.39	Open
P11	16.79	0.53	2.32	Open
P12	43.21	1.38	13.34	Open
P13	60.00	1.91	24.50	Open
P14	60.00	1.91	24.50	Open
P15	75.27	2.40	37.28	Open
P16	15.52	0.49	2.00	Open
P17	15.52	0.49	2.00	Open
P18	59.75	1.90	24.31	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	75.52	2.40	37.52	Open
P20	-11.89	0.38	1.22	Open
P21	63.62	2.03	27.31	Open
P22	71.42	2.27	33.83	Open
P23	71.12	2.26	33.57	Open
P24	70.83	2.25	33.32	Open
P25	70.68	2.25	33.19	Open
P26	70.68	2.25	33.19	Open
P27	70.54	2.25	33.06	Open
P28	-63.31	2.02	27.06	Open
P29	-63.35	2.02	27.09	Open
P30	-63.44	2.02	27.17	Open
P31	63.50	2.02	27.21	Open
P32	133.85	4.26	108.28	Open
P33	133.70	4.26	108.06	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	16.96	0.54	2.36	Open
1	60.87	0.00	-302.47	Open Pump
2	75.27	0.00	-299.01	Open Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.47	51.17	0.00	
J2	0.00	301.92	51.07	0.00	
J3	0.08	300.15	51.79	0.00	
J4	0.07	298.97	52.01	0.00	
J5	0.00	298.49	52.15	0.00	
J6	0.30	298.41	52.46	0.00	
J7	0.10	300.97	51.60	0.00	
J8	0.05	299.50	51.93	0.00	
J9	0.10	298.31	52.73	0.00	
J11	0.17	298.18	52.73	0.00	
J12	0.00	298.10	52.41	0.00	
J13	0.00	297.21	52.06	0.00	
J14	0.00	297.08	52.01	0.00	
J15	0.00	297.15	52.39	0.00	
J16	0.00	297.17	52.26	0.00	
J17	0.22	296.79	52.13	0.00	
J19	0.29	295.48	51.10	0.00	
J20	0.29	293.74	49.74	0.00	
J21	0.15	292.41	48.70	0.00	
J22	0.15	291.44	47.81	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	291.02	47.35	0.00	
J24	0.15	288.26	44.39	0.00	
J25	133.46	287.44	43.57	0.00	
J26	0.18	287.44	43.64	0.00	
J27	0.00	287.44	43.64	0.00	
J28	0.05	287.44	43.64	0.00	
J29	0.04	291.81	47.93	0.00	
J30	0.09	292.35	48.33	0.00	
J31	0.05	293.56	49.22	0.00	
J32	0.13	296.16	51.11	0.00	
J33	0.00	299.01	53.36	0.00	
J34	0.00	296.84	51.76	0.00	
J35	0.00	291.85	48.26	0.00	
R1	-60.87	0.00	0.00	0.00	Reservoir
R2	-75.27	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	60.87	1.94	25.16	Open
P4	60.57	1.93	24.93	Open
P5	17.36	0.55	2.47	Open
P6	60.87	1.94	25.16	Open
P7	60.77	1.93	25.09	Open
P8	60.69	1.93	25.02	Open
P9	60.64	1.93	24.98	Open
P2	17.06	0.54	2.39	Open
P11	16.79	0.53	2.32	Open
P12	43.21	1.38	13.34	Open
P13	60.00	1.91	24.50	Open
P14	60.00	1.91	24.50	Open
P15	75.27	2.40	37.28	Open
P16	15.52	0.49	2.00	Open
P17	15.52	0.49	2.00	Open
P18	59.75	1.90	24.31	Open
P19	75.52	2.40	37.52	Open
P20	-11.89	0.38	1.22	Open
P21	63.62	2.03	27.31	Open
P22	71.42	2.27	33.83	Open
P23	71.12	2.26	33.57	Open
P24	70.83	2.25	33.32	Open
P25	70.68	2.25	33.19	Open
P26	70.68	2.25	33.19	Open
P27	70.54	2.25	33.06	Open
P28	-63.31	2.02	27.06	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	-63.35	2.02	27.09	Open
P30	-63.44	2.02	27.17	Open
P31	63.50	2.02	27.21	Open
P32	133.85	4.26	108.28	Open
P33	133.70	4.26	108.06	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	16.96	0.54	2.36	Open
1	60.87	0.00	-302.47	Open Pump
2	75.27	0.00	-299.01	Open Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.47	51.17	0.00	
J2	0.00	301.92	51.07	0.00	
J3	0.08	300.15	51.79	0.00	
J4	0.07	298.97	52.01	0.00	
J5	0.00	298.49	52.15	0.00	
J6	0.30	298.41	52.46	0.00	
J7	0.10	300.97	51.60	0.00	
J8	0.05	299.50	51.93	0.00	
J9	0.10	298.31	52.73	0.00	
J11	0.17	298.18	52.73	0.00	
J12	0.00	298.10	52.41	0.00	
J13	0.00	297.21	52.06	0.00	
J14	0.00	297.08	52.01	0.00	
J15	0.00	297.15	52.39	0.00	
J16	0.00	297.17	52.26	0.00	
J17	0.22	296.79	52.13	0.00	
J19	0.29	295.48	51.10	0.00	
J20	0.29	293.74	49.74	0.00	
J21	0.15	292.41	48.70	0.00	
J22	0.15	291.44	47.81	0.00	
J23	0.00	291.02	47.35	0.00	
J24	0.15	288.26	44.39	0.00	
J25	133.46	287.44	43.57	0.00	
J26	0.18	287.44	43.64	0.00	
J27	0.00	287.44	43.64	0.00	
J28	0.05	287.44	43.64	0.00	
J29	0.04	291.81	47.93	0.00	
J30	0.09	292.35	48.33	0.00	
J31	0.05	293.56	49.22	0.00	
J32	0.13	296.16	51.11	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	299.01	53.36	0.00	
J34	0.00	296.84	51.76	0.00	
J35	0.00	291.85	48.26	0.00	
R1	-60.87	0.00	0.00	0.00	Reservoir
R2	-75.27	0.00	0.00	0.00	Reservoir

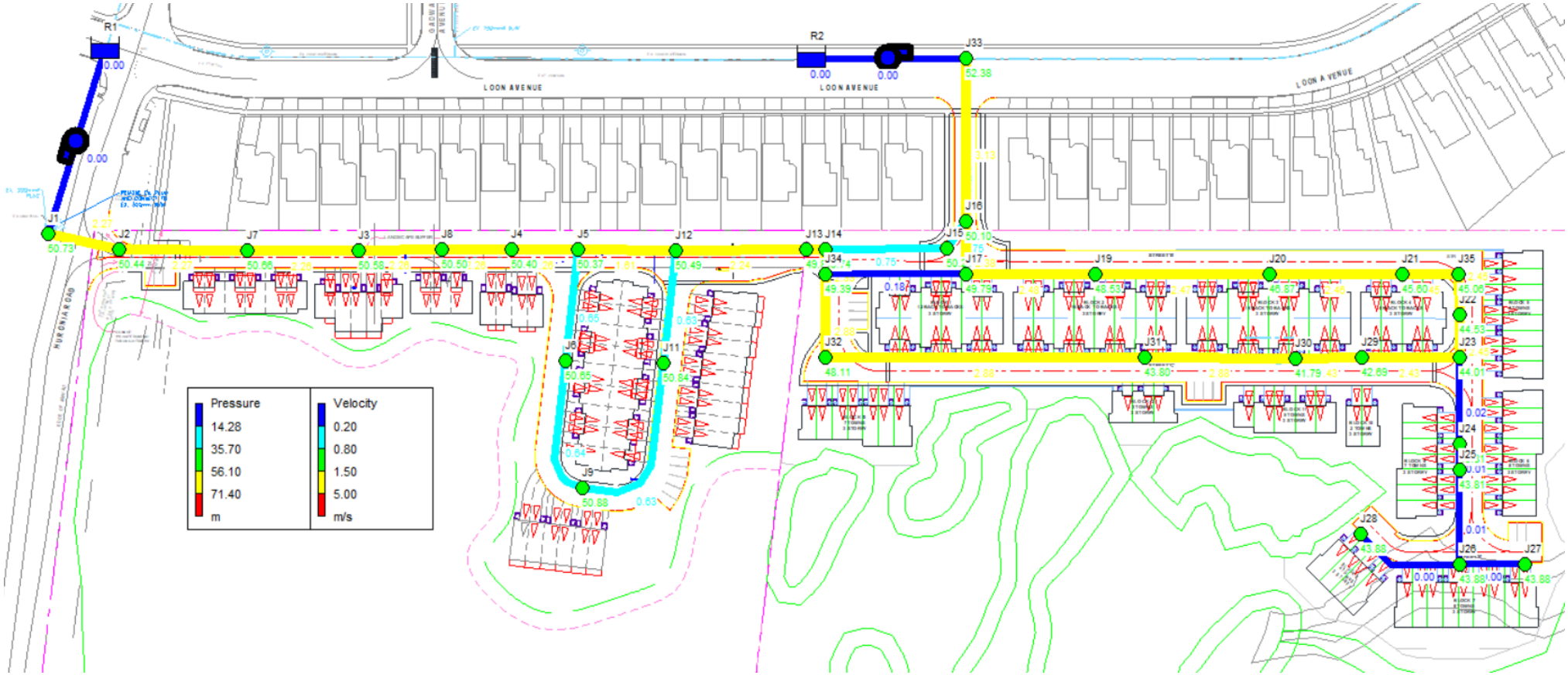
Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	60.87	1.94	25.16	Open
P4	60.57	1.93	24.93	Open
P5	17.36	0.55	2.47	Open
P6	60.87	1.94	25.16	Open
P7	60.77	1.93	25.09	Open
P8	60.69	1.93	25.02	Open
P9	60.64	1.93	24.98	Open
P2	17.06	0.54	2.39	Open
P11	16.79	0.53	2.32	Open
P12	43.21	1.38	13.34	Open
P13	60.00	1.91	24.50	Open
P14	60.00	1.91	24.50	Open
P15	75.27	2.40	37.28	Open
P16	15.52	0.49	2.00	Open
P17	15.52	0.49	2.00	Open
P18	59.75	1.90	24.31	Open
P19	75.52	2.40	37.52	Open
P20	-11.89	0.38	1.22	Open
P21	63.62	2.03	27.31	Open
P22	71.42	2.27	33.83	Open
P23	71.12	2.26	33.57	Open
P24	70.83	2.25	33.32	Open
P25	70.68	2.25	33.19	Open
P26	70.68	2.25	33.19	Open
P27	70.54	2.25	33.06	Open
P28	-63.31	2.02	27.06	Open
P29	-63.35	2.02	27.09	Open
P30	-63.44	2.02	27.17	Open
P31	63.50	2.02	27.21	Open
P32	133.85	4.26	108.28	Open
P33	133.70	4.26	108.06	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	16.96	0.54	2.36	Open
1	60.87	0.00	-302.47	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	75.27	0.00	-299.01	Open Pump

Max Day + Fire Flow Demand Conditions at Block 11 (J30) Schematic



Project No: 21076
January 2022

Prepared by: JL

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**************************************************************************
*                          E P A N E T                                   *
*                    Hydraulic and Water Quality                         *
*                    Analysis for Pipe Networks                          *
*                         Version 2.2                                    *
**************************************************************************

Input File: 21076_Max Day + Fire @ Block 11.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	150
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	280.94	280.94	0.00
2	100.00	75.00	1.08	382.90	382.90	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	302.03	50.73	0.00
J2	0.00	301.29	50.44	0.00
J3	0.08	298.93	50.58	0.00
J4	0.07	297.36	50.40	0.00
J5	0.00	296.71	50.37	0.00
J6	0.30	296.60	50.65	0.00
J7	0.10	300.03	50.66	0.00
J8	0.05	298.07	50.50	0.00
J9	0.10	296.46	50.88	0.00
J11	0.17	296.29	50.84	0.00
J12	0.00	296.18	50.49	0.00
J13	0.00	295.00	49.85	0.00
J14	0.00	294.81	49.74	0.00
J15	0.00	294.97	50.21	0.00
J16	0.00	295.01	50.10	0.00
J17	0.22	294.45	49.79	0.00
J19	0.29	292.91	48.53	0.00
J20	0.29	290.87	46.87	0.00
J21	0.15	289.31	45.60	0.00
J22	0.15	288.16	44.53	0.00
J23	0.00	287.68	44.01	0.00
J24	0.15	287.68	43.81	0.00
J25	0.13	287.68	43.81	0.00
J26	0.18	287.68	43.88	0.00
J27	0.00	287.68	43.88	0.00
J28	0.05	287.68	43.88	0.00

J29	0.04	286.57	42.69	0.00	
J30	166.76	285.81	41.79	0.00	
J31	0.05	288.14	43.80	0.00	
J32	0.13	293.16	48.11	0.00	
J33	0.00	298.03	52.38	0.00	
J34	0.00	294.47	49.39	0.00	
J35	0.00	288.65	45.06	0.00	
R1	-71.17	0.00	0.00	0.00	Reservoir
R2	-98.30	0.00	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	71.17	2.27	33.61	Open
P4	70.87	2.26	33.35	Open
P5	20.27	0.65	3.28	Open
P6	71.17	2.27	33.61	Open
P7	71.07	2.26	33.52	Open
P8	70.98	2.26	33.45	Open
P9	70.93	2.26	33.41	Open
P2	19.97	0.64	3.19	Open
P11	19.70	0.63	3.12	Open
P12	50.59	1.61	17.87	Open
P13	70.30	2.24	32.85	Open
P14	70.30	2.24	32.85	Open
P15	98.30	3.13	61.13	Open
P16	23.54	0.75	4.33	Open
P17	23.54	0.75	4.33	Open
P18	74.76	2.38	36.82	Open
P19	93.84	2.99	56.09	Open
P20	-3.26	0.18	0.54	Open
P21	90.58	2.88	52.54	Open
P22	77.80	2.48	39.64	Open
P23	77.50	2.47	39.36	Open
P24	77.21	2.46	39.08	Open
P25	77.06	2.45	38.95	Open
P26	77.06	2.45	38.95	Open
P27	76.91	2.45	38.81	Open
P28	76.40	2.43	38.33	Open
P29	76.36	2.43	38.29	Open
P30	-90.40	2.88	52.34	Open
P31	90.45	2.88	52.40	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open

P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.87	0.63	3.16	Open
1	71.17	0.00	-302.03	Open Pump
2	98.30	0.00	-298.03	Open Pump

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Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.03	50.73	0.00	
J2	0.00	301.29	50.44	0.00	
J3	0.08	298.93	50.58	0.00	
J4	0.07	297.36	50.40	0.00	
J5	0.00	296.71	50.37	0.00	
J6	0.30	296.60	50.65	0.00	
J7	0.10	300.03	50.66	0.00	
J8	0.05	298.07	50.50	0.00	
J9	0.10	296.46	50.88	0.00	
J11	0.17	296.29	50.84	0.00	
J12	0.00	296.18	50.49	0.00	
J13	0.00	295.00	49.85	0.00	
J14	0.00	294.81	49.74	0.00	
J15	0.00	294.97	50.21	0.00	
J16	0.00	295.01	50.10	0.00	
J17	0.22	294.45	49.79	0.00	
J19	0.29	292.91	48.53	0.00	
J20	0.29	290.87	46.87	0.00	
J21	0.15	289.31	45.60	0.00	
J22	0.15	288.16	44.53	0.00	
J23	0.00	287.68	44.01	0.00	
J24	0.15	287.68	43.81	0.00	
J25	0.13	287.68	43.81	0.00	
J26	0.18	287.68	43.88	0.00	
J27	0.00	287.68	43.88	0.00	
J28	0.05	287.68	43.88	0.00	
J29	0.04	286.57	42.69	0.00	
J30	166.76	285.81	41.79	0.00	
J31	0.05	288.14	43.80	0.00	
J32	0.13	293.16	48.11	0.00	
J33	0.00	298.03	52.38	0.00	
J34	0.00	294.47	49.39	0.00	
J35	0.00	288.65	45.06	0.00	
R1	-71.17	0.00	0.00	0.00	Reservoir
R2	-98.30	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	71.17	2.27	33.61	Open
P4	70.87	2.26	33.35	Open
P5	20.27	0.65	3.29	Open
P6	71.17	2.27	33.61	Open
P7	71.07	2.26	33.52	Open
P8	70.98	2.26	33.45	Open

Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P9	70.93	2.26	33.41	Open
P2	19.97	0.64	3.19	Open
P11	19.70	0.63	3.12	Open
P12	50.59	1.61	17.87	Open
P13	70.30	2.24	32.85	Open
P14	70.30	2.24	32.85	Open
P15	98.30	3.13	61.13	Open
P16	23.54	0.75	4.33	Open
P17	23.54	0.75	4.33	Open
P18	74.76	2.38	36.82	Open
P19	93.84	2.99	56.09	Open
P20	-3.26	0.18	0.54	Open
P21	90.58	2.88	52.54	Open
P22	77.80	2.48	39.64	Open
P23	77.50	2.47	39.36	Open
P24	77.21	2.46	39.08	Open
P25	77.06	2.45	38.95	Open
P26	77.06	2.45	38.95	Open
P27	76.91	2.45	38.81	Open
P28	76.40	2.43	38.33	Open
P29	76.36	2.43	38.29	Open
P30	-90.40	2.88	52.34	Open
P31	90.45	2.88	52.40	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.87	0.63	3.16	Open
1	71.17	0.00	-302.03	Open Pump
2	98.30	0.00	-298.03	Open Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.03	50.73	0.00	
J2	0.00	301.29	50.44	0.00	
J3	0.08	298.93	50.58	0.00	
J4	0.07	297.36	50.40	0.00	
J5	0.00	296.71	50.37	0.00	
J6	0.30	296.60	50.65	0.00	
J7	0.10	300.03	50.66	0.00	
J8	0.05	298.07	50.50	0.00	
J9	0.10	296.46	50.88	0.00	
J11	0.17	296.29	50.84	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	296.18	50.49	0.00	
J13	0.00	295.00	49.85	0.00	
J14	0.00	294.81	49.74	0.00	
J15	0.00	294.97	50.21	0.00	
J16	0.00	295.01	50.10	0.00	
J17	0.22	294.45	49.79	0.00	
J19	0.29	292.91	48.53	0.00	
J20	0.29	290.87	46.87	0.00	
J21	0.15	289.31	45.60	0.00	
J22	0.15	288.16	44.53	0.00	
J23	0.00	287.68	44.01	0.00	
J24	0.15	287.68	43.81	0.00	
J25	0.13	287.68	43.81	0.00	
J26	0.18	287.68	43.88	0.00	
J27	0.00	287.68	43.88	0.00	
J28	0.05	287.68	43.88	0.00	
J29	0.04	286.57	42.69	0.00	
J30	166.76	285.81	41.79	0.00	
J31	0.05	288.14	43.80	0.00	
J32	0.13	293.16	48.11	0.00	
J33	0.00	298.03	52.38	0.00	
J34	0.00	294.47	49.39	0.00	
J35	0.00	288.65	45.06	0.00	
R1	-71.17	0.00	0.00	0.00	Reservoir
R2	-98.30	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	71.17	2.27	33.61	Open
P4	70.87	2.26	33.35	Open
P5	20.27	0.65	3.28	Open
P6	71.17	2.27	33.61	Open
P7	71.07	2.26	33.52	Open
P8	70.98	2.26	33.45	Open
P9	70.93	2.26	33.41	Open
P2	19.97	0.64	3.19	Open
P11	19.70	0.63	3.12	Open
P12	50.59	1.61	17.87	Open
P13	70.30	2.24	32.85	Open
P14	70.30	2.24	32.85	Open
P15	98.30	3.13	61.13	Open
P16	23.54	0.75	4.33	Open
P17	23.54	0.75	4.33	Open
P18	74.76	2.38	36.82	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	93.84	2.99	56.09	Open
P20	-3.26	0.18	0.54	Open
P21	90.58	2.88	52.54	Open
P22	77.80	2.48	39.64	Open
P23	77.50	2.47	39.36	Open
P24	77.21	2.46	39.08	Open
P25	77.06	2.45	38.95	Open
P26	77.06	2.45	38.95	Open
P27	76.91	2.45	38.81	Open
P28	76.40	2.43	38.33	Open
P29	76.36	2.43	38.29	Open
P30	-90.40	2.88	52.34	Open
P31	90.45	2.88	52.40	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.87	0.63	3.16	Open
1	71.17	0.00	-302.03	Open Pump
2	98.30	0.00	-298.03	Open Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.03	50.73	0.00	
J2	0.00	301.29	50.44	0.00	
J3	0.08	298.93	50.58	0.00	
J4	0.07	297.36	50.40	0.00	
J5	0.00	296.71	50.37	0.00	
J6	0.30	296.60	50.65	0.00	
J7	0.10	300.03	50.66	0.00	
J8	0.05	298.07	50.50	0.00	
J9	0.10	296.46	50.88	0.00	
J11	0.17	296.29	50.84	0.00	
J12	0.00	296.18	50.49	0.00	
J13	0.00	295.00	49.85	0.00	
J14	0.00	294.81	49.74	0.00	
J15	0.00	294.97	50.21	0.00	
J16	0.00	295.01	50.10	0.00	
J17	0.22	294.45	49.79	0.00	
J19	0.29	292.91	48.53	0.00	
J20	0.29	290.87	46.87	0.00	
J21	0.15	289.31	45.60	0.00	
J22	0.15	288.16	44.53	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	287.68	44.01	0.00	
J24	0.15	287.68	43.81	0.00	
J25	0.13	287.68	43.81	0.00	
J26	0.18	287.68	43.88	0.00	
J27	0.00	287.68	43.88	0.00	
J28	0.05	287.68	43.88	0.00	
J29	0.04	286.57	42.69	0.00	
J30	166.76	285.81	41.79	0.00	
J31	0.05	288.14	43.80	0.00	
J32	0.13	293.16	48.11	0.00	
J33	0.00	298.03	52.38	0.00	
J34	0.00	294.47	49.39	0.00	
J35	0.00	288.65	45.06	0.00	
R1	-71.17	0.00	0.00	0.00	Reservoir
R2	-98.30	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	71.17	2.27	33.61	Open
P4	70.87	2.26	33.35	Open
P5	20.27	0.65	3.28	Open
P6	71.17	2.27	33.61	Open
P7	71.07	2.26	33.52	Open
P8	70.98	2.26	33.45	Open
P9	70.93	2.26	33.41	Open
P2	19.97	0.64	3.19	Open
P11	19.70	0.63	3.12	Open
P12	50.59	1.61	17.87	Open
P13	70.30	2.24	32.85	Open
P14	70.30	2.24	32.85	Open
P15	98.30	3.13	61.13	Open
P16	23.54	0.75	4.33	Open
P17	23.54	0.75	4.33	Open
P18	74.76	2.38	36.82	Open
P19	93.84	2.99	56.09	Open
P20	-3.26	0.18	0.54	Open
P21	90.58	2.88	52.54	Open
P22	77.80	2.48	39.64	Open
P23	77.50	2.47	39.36	Open
P24	77.21	2.46	39.08	Open
P25	77.06	2.45	38.95	Open
P26	77.06	2.45	38.95	Open
P27	76.91	2.45	38.81	Open
P28	76.40	2.43	38.33	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	76.36	2.43	38.29	Open
P30	-90.40	2.88	52.34	Open
P31	90.45	2.88	52.40	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.87	0.63	3.16	Open
1	71.17	0.00	-302.03	Open Pump
2	98.30	0.00	-298.03	Open Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.03	50.73	0.00	
J2	0.00	301.29	50.44	0.00	
J3	0.08	298.93	50.58	0.00	
J4	0.07	297.36	50.40	0.00	
J5	0.00	296.71	50.37	0.00	
J6	0.30	296.60	50.65	0.00	
J7	0.10	300.03	50.66	0.00	
J8	0.05	298.07	50.50	0.00	
J9	0.10	296.46	50.88	0.00	
J11	0.17	296.29	50.84	0.00	
J12	0.00	296.18	50.49	0.00	
J13	0.00	295.00	49.85	0.00	
J14	0.00	294.81	49.74	0.00	
J15	0.00	294.97	50.21	0.00	
J16	0.00	295.01	50.10	0.00	
J17	0.22	294.45	49.79	0.00	
J19	0.29	292.91	48.53	0.00	
J20	0.29	290.87	46.87	0.00	
J21	0.15	289.31	45.60	0.00	
J22	0.15	288.16	44.53	0.00	
J23	0.00	287.68	44.01	0.00	
J24	0.15	287.68	43.81	0.00	
J25	0.13	287.68	43.81	0.00	
J26	0.18	287.68	43.88	0.00	
J27	0.00	287.68	43.88	0.00	
J28	0.05	287.68	43.88	0.00	
J29	0.04	286.57	42.69	0.00	
J30	166.76	285.81	41.79	0.00	
J31	0.05	288.14	43.80	0.00	
J32	0.13	293.16	48.11	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	298.03	52.38	0.00	
J34	0.00	294.47	49.39	0.00	
J35	0.00	288.65	45.06	0.00	
R1	-71.17	0.00	0.00	0.00	Reservoir
R2	-98.30	0.00	0.00	0.00	Reservoir

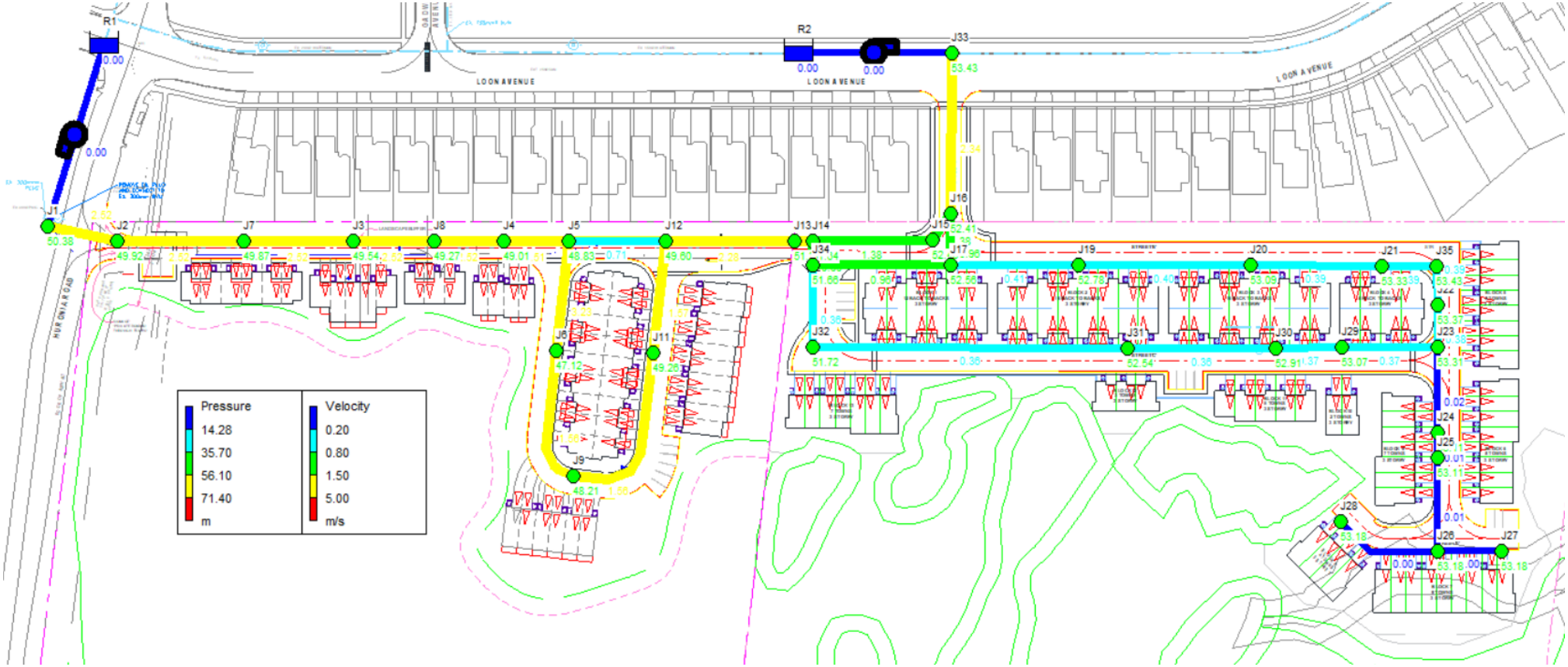
Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	71.17	2.27	33.61	Open
P4	70.87	2.26	33.35	Open
P5	20.27	0.65	3.28	Open
P6	71.17	2.27	33.61	Open
P7	71.07	2.26	33.52	Open
P8	70.98	2.26	33.45	Open
P9	70.93	2.26	33.41	Open
P2	19.97	0.64	3.19	Open
P11	19.70	0.63	3.12	Open
P12	50.59	1.61	17.87	Open
P13	70.30	2.24	32.85	Open
P14	70.30	2.24	32.85	Open
P15	98.30	3.13	61.13	Open
P16	23.54	0.75	4.33	Open
P17	23.54	0.75	4.33	Open
P18	74.76	2.38	36.82	Open
P19	93.84	2.99	56.09	Open
P20	-3.26	0.18	0.54	Open
P21	90.58	2.88	52.54	Open
P22	77.80	2.48	39.64	Open
P23	77.50	2.47	39.36	Open
P24	77.21	2.46	39.08	Open
P25	77.06	2.45	38.95	Open
P26	77.06	2.45	38.95	Open
P27	76.91	2.45	38.81	Open
P28	76.40	2.43	38.33	Open
P29	76.36	2.43	38.29	Open
P30	-90.40	2.88	52.34	Open
P31	90.45	2.88	52.40	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	19.87	0.63	3.16	Open
1	71.17	0.00	-302.03	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	98.30	0.00	-298.03	Open Pump

Max Day + Fire Flow Demand Conditions at External 521 Huronia Road Lands - Block 5 (J6) Schematic



Project No: 21076
January 2022

Prepared by: JL

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*                          E P A N E T                                   *
*                   Hydraulic and Water Quality                          *
*                   Analysis for Pipe Networks                           *
*                         Version 2.2                                    *
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Input File: 21076_Max Day + Fire @ Huronia Block 5.net
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Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	150
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	312.70	312.70	0.00
2	100.00	75.00	1.09	287.29	287.29	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	301.68	50.38	0.00
J2	0.00	300.77	49.92	0.00
J3	0.08	297.90	49.54	0.00
J4	0.07	295.97	49.01	0.00
J5	0.00	295.17	48.83	0.00
J6	150.30	293.07	47.12	0.00
J7	0.10	299.24	49.87	0.00
J8	0.05	296.84	49.27	0.00
J9	0.10	293.79	48.21	0.00
J11	0.17	294.71	49.26	0.00
J12	0.00	295.29	49.60	0.00
J13	0.00	296.51	51.36	0.00
J14	0.00	296.71	51.64	0.00
J15	0.00	297.19	52.43	0.00
J16	0.00	297.32	52.41	0.00
J17	0.22	297.22	52.56	0.00
J19	0.29	297.16	52.78	0.00
J20	0.29	297.09	53.09	0.00
J21	0.15	297.04	53.33	0.00
J22	0.15	297.00	53.37	0.00
J23	0.00	296.98	53.31	0.00
J24	0.15	296.98	53.11	0.00
J25	0.13	296.98	53.11	0.00
J26	0.18	296.98	53.18	0.00
J27	0.00	296.98	53.18	0.00
J28	0.05	296.98	53.18	0.00

J29	0.04	296.95	53.07	0.00	
J30	0.09	296.93	52.91	0.00	
J31	0.05	296.88	52.54	0.00	
J32	0.13	296.77	51.72	0.00	
J33	0.00	299.08	53.43	0.00	
J34	0.00	296.74	51.66	0.00	
J35	0.00	297.02	53.43	0.00	
R1	-79.31	0.00	0.00	0.00	Reservoir
R2	-73.50	0.00	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	79.31	2.52	41.08	Open
P4	79.01	2.51	40.79	Open
P5	101.39	3.23	64.74	Open
P6	79.31	2.52	41.08	Open
P7	79.21	2.52	40.98	Open
P8	79.12	2.52	40.90	Open
P9	79.07	2.52	40.85	Open
P2	-48.91	1.56	16.78	Open
P11	-49.18	1.57	16.95	Open
P12	-22.39	0.71	3.95	Open
P13	-71.57	2.28	33.96	Open
P14	-71.57	2.28	33.96	Open
P15	73.50	2.34	35.68	Open
P16	43.43	1.38	13.47	Open
P17	43.43	1.38	13.47	Open
P18	30.06	0.96	6.81	Open
P19	-28.13	0.90	6.03	Open
P20	16.90	0.96	11.36	Open
P21	-11.23	0.36	1.10	Open
P22	12.94	0.41	1.43	Open
P23	12.65	0.40	1.37	Open
P24	12.35	0.39	1.31	Open
P25	12.21	0.39	1.28	Open
P26	12.21	0.39	1.28	Open
P27	12.06	0.38	1.26	Open
P28	11.54	0.37	1.16	Open
P29	11.51	0.37	1.15	Open
P30	11.42	0.36	1.13	Open
P31	-11.36	0.36	1.12	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open

P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-49.01	1.56	16.85	Open
1	79.31	0.00	-301.68	Open Pump
2	73.50	0.00	-299.08	Open Pump

Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	301.68	50.38	0.00	
J2	0.00	300.77	49.92	0.00	
J3	0.08	297.90	49.54	0.00	
J4	0.07	295.97	49.01	0.00	
J5	0.00	295.17	48.83	0.00	
J6	150.30	293.07	47.12	0.00	
J7	0.10	299.24	49.87	0.00	
J8	0.05	296.84	49.27	0.00	
J9	0.10	293.79	48.21	0.00	
J11	0.17	294.71	49.26	0.00	
J12	0.00	295.29	49.60	0.00	
J13	0.00	296.51	51.36	0.00	
J14	0.00	296.71	51.64	0.00	
J15	0.00	297.19	52.43	0.00	
J16	0.00	297.32	52.41	0.00	
J17	0.22	297.22	52.56	0.00	
J19	0.29	297.16	52.78	0.00	
J20	0.29	297.09	53.09	0.00	
J21	0.15	297.04	53.33	0.00	
J22	0.15	297.00	53.37	0.00	
J23	0.00	296.98	53.31	0.00	
J24	0.15	296.98	53.11	0.00	
J25	0.13	296.98	53.11	0.00	
J26	0.18	296.98	53.18	0.00	
J27	0.00	296.98	53.18	0.00	
J28	0.05	296.98	53.18	0.00	
J29	0.04	296.95	53.07	0.00	
J30	0.09	296.93	52.91	0.00	
J31	0.05	296.88	52.54	0.00	
J32	0.13	296.77	51.72	0.00	
J33	0.00	299.08	53.43	0.00	
J34	0.00	296.74	51.66	0.00	
J35	0.00	297.02	53.43	0.00	
R1	-79.31	0.00	0.00	0.00	Reservoir
R2	-73.50	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	79.31	2.52	41.08	Open
P4	79.01	2.51	40.79	Open
P5	101.39	3.23	64.74	Open
P6	79.31	2.52	41.08	Open
P7	79.21	2.52	40.98	Open
P8	79.12	2.52	40.90	Open

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Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P9	79.07	2.52	40.85	Open
P2	-48.91	1.56	16.78	Open
P11	-49.18	1.57	16.95	Open
P12	-22.39	0.71	3.95	Open
P13	-71.57	2.28	33.96	Open
P14	-71.57	2.28	33.96	Open
P15	73.50	2.34	35.68	Open
P16	43.43	1.38	13.47	Open
P17	43.43	1.38	13.47	Open
P18	30.06	0.96	6.81	Open
P19	-28.13	0.90	6.03	Open
P20	16.90	0.96	11.36	Open
P21	-11.23	0.36	1.10	Open
P22	12.94	0.41	1.43	Open
P23	12.65	0.40	1.37	Open
P24	12.35	0.39	1.31	Open
P25	12.21	0.39	1.28	Open
P26	12.21	0.39	1.28	Open
P27	12.06	0.38	1.26	Open
P28	11.54	0.37	1.16	Open
P29	11.51	0.37	1.15	Open
P30	11.42	0.36	1.13	Open
P31	-11.36	0.36	1.12	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-49.01	1.56	16.85	Open
1	79.31	0.00	-301.68	Open Pump
2	73.50	0.00	-299.08	Open Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	301.68	50.38	0.00	
J2	0.00	300.77	49.92	0.00	
J3	0.08	297.90	49.54	0.00	
J4	0.07	295.97	49.01	0.00	
J5	0.00	295.17	48.83	0.00	
J6	150.30	293.07	47.12	0.00	
J7	0.10	299.24	49.87	0.00	
J8	0.05	296.84	49.27	0.00	
J9	0.10	293.79	48.21	0.00	
J11	0.17	294.71	49.26	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	295.29	49.60	0.00	
J13	0.00	296.51	51.36	0.00	
J14	0.00	296.71	51.64	0.00	
J15	0.00	297.19	52.43	0.00	
J16	0.00	297.32	52.41	0.00	
J17	0.22	297.22	52.56	0.00	
J19	0.29	297.16	52.78	0.00	
J20	0.29	297.09	53.09	0.00	
J21	0.15	297.04	53.33	0.00	
J22	0.15	297.00	53.37	0.00	
J23	0.00	296.98	53.31	0.00	
J24	0.15	296.98	53.11	0.00	
J25	0.13	296.98	53.11	0.00	
J26	0.18	296.98	53.18	0.00	
J27	0.00	296.98	53.18	0.00	
J28	0.05	296.98	53.18	0.00	
J29	0.04	296.95	53.07	0.00	
J30	0.09	296.93	52.91	0.00	
J31	0.05	296.88	52.54	0.00	
J32	0.13	296.77	51.72	0.00	
J33	0.00	299.08	53.43	0.00	
J34	0.00	296.74	51.66	0.00	
J35	0.00	297.02	53.43	0.00	
R1	-79.31	0.00	0.00	0.00	Reservoir
R2	-73.50	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	79.31	2.52	41.08	Open
P4	79.01	2.51	40.79	Open
P5	101.39	3.23	64.74	Open
P6	79.31	2.52	41.08	Open
P7	79.21	2.52	40.98	Open
P8	79.12	2.52	40.90	Open
P9	79.07	2.52	40.85	Open
P2	-48.91	1.56	16.78	Open
P11	-49.18	1.57	16.95	Open
P12	-22.39	0.71	3.95	Open
P13	-71.57	2.28	33.96	Open
P14	-71.57	2.28	33.96	Open
P15	73.50	2.34	35.68	Open
P16	43.43	1.38	13.47	Open
P17	43.43	1.38	13.47	Open
P18	30.06	0.96	6.81	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	-28.13	0.90	6.03	Open
P20	16.90	0.96	11.36	Open
P21	-11.23	0.36	1.10	Open
P22	12.94	0.41	1.43	Open
P23	12.65	0.40	1.37	Open
P24	12.35	0.39	1.31	Open
P25	12.21	0.39	1.28	Open
P26	12.21	0.39	1.28	Open
P27	12.06	0.38	1.26	Open
P28	11.54	0.37	1.16	Open
P29	11.51	0.37	1.15	Open
P30	11.42	0.36	1.13	Open
P31	-11.36	0.36	1.12	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-49.01	1.56	16.85	Open
1	79.31	0.00	-301.68	Open Pump
2	73.50	0.00	-299.08	Open Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	301.68	50.38	0.00	
J2	0.00	300.77	49.92	0.00	
J3	0.08	297.90	49.54	0.00	
J4	0.07	295.97	49.01	0.00	
J5	0.00	295.17	48.83	0.00	
J6	150.30	293.07	47.12	0.00	
J7	0.10	299.24	49.87	0.00	
J8	0.05	296.84	49.27	0.00	
J9	0.10	293.79	48.21	0.00	
J11	0.17	294.71	49.26	0.00	
J12	0.00	295.29	49.60	0.00	
J13	0.00	296.51	51.36	0.00	
J14	0.00	296.71	51.64	0.00	
J15	0.00	297.19	52.43	0.00	
J16	0.00	297.32	52.41	0.00	
J17	0.22	297.22	52.56	0.00	
J19	0.29	297.16	52.78	0.00	
J20	0.29	297.09	53.09	0.00	
J21	0.15	297.04	53.33	0.00	
J22	0.15	297.00	53.37	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	296.98	53.31	0.00	
J24	0.15	296.98	53.11	0.00	
J25	0.13	296.98	53.11	0.00	
J26	0.18	296.98	53.18	0.00	
J27	0.00	296.98	53.18	0.00	
J28	0.05	296.98	53.18	0.00	
J29	0.04	296.95	53.07	0.00	
J30	0.09	296.93	52.91	0.00	
J31	0.05	296.88	52.54	0.00	
J32	0.13	296.77	51.72	0.00	
J33	0.00	299.08	53.43	0.00	
J34	0.00	296.74	51.66	0.00	
J35	0.00	297.02	53.43	0.00	
R1	-79.31	0.00	0.00	0.00	Reservoir
R2	-73.50	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	79.31	2.52	41.08	Open
P4	79.01	2.51	40.79	Open
P5	101.39	3.23	64.74	Open
P6	79.31	2.52	41.08	Open
P7	79.21	2.52	40.98	Open
P8	79.12	2.52	40.90	Open
P9	79.07	2.52	40.85	Open
P2	-48.91	1.56	16.78	Open
P11	-49.18	1.57	16.95	Open
P12	-22.39	0.71	3.95	Open
P13	-71.57	2.28	33.96	Open
P14	-71.57	2.28	33.96	Open
P15	73.50	2.34	35.68	Open
P16	43.43	1.38	13.47	Open
P17	43.43	1.38	13.47	Open
P18	30.06	0.96	6.81	Open
P19	-28.13	0.90	6.03	Open
P20	16.90	0.96	11.36	Open
P21	-11.23	0.36	1.10	Open
P22	12.94	0.41	1.43	Open
P23	12.65	0.40	1.37	Open
P24	12.35	0.39	1.31	Open
P25	12.21	0.39	1.28	Open
P26	12.21	0.39	1.28	Open
P27	12.06	0.38	1.26	Open
P28	11.54	0.37	1.16	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	11.51	0.37	1.15	Open
P30	11.42	0.36	1.13	Open
P31	-11.36	0.36	1.12	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-49.01	1.56	16.85	Open
1	79.31	0.00	-301.68	Open Pump
2	73.50	0.00	-299.08	Open Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	301.68	50.38	0.00	
J2	0.00	300.77	49.92	0.00	
J3	0.08	297.90	49.54	0.00	
J4	0.07	295.97	49.01	0.00	
J5	0.00	295.17	48.83	0.00	
J6	150.30	293.07	47.12	0.00	
J7	0.10	299.24	49.87	0.00	
J8	0.05	296.84	49.27	0.00	
J9	0.10	293.79	48.21	0.00	
J11	0.17	294.71	49.26	0.00	
J12	0.00	295.29	49.60	0.00	
J13	0.00	296.51	51.36	0.00	
J14	0.00	296.71	51.64	0.00	
J15	0.00	297.19	52.43	0.00	
J16	0.00	297.32	52.41	0.00	
J17	0.22	297.22	52.56	0.00	
J19	0.29	297.16	52.78	0.00	
J20	0.29	297.09	53.09	0.00	
J21	0.15	297.04	53.33	0.00	
J22	0.15	297.00	53.37	0.00	
J23	0.00	296.98	53.31	0.00	
J24	0.15	296.98	53.11	0.00	
J25	0.13	296.98	53.11	0.00	
J26	0.18	296.98	53.18	0.00	
J27	0.00	296.98	53.18	0.00	
J28	0.05	296.98	53.18	0.00	
J29	0.04	296.95	53.07	0.00	
J30	0.09	296.93	52.91	0.00	
J31	0.05	296.88	52.54	0.00	
J32	0.13	296.77	51.72	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	299.08	53.43	0.00	
J34	0.00	296.74	51.66	0.00	
J35	0.00	297.02	53.43	0.00	
R1	-79.31	0.00	0.00	0.00	Reservoir
R2	-73.50	0.00	0.00	0.00	Reservoir

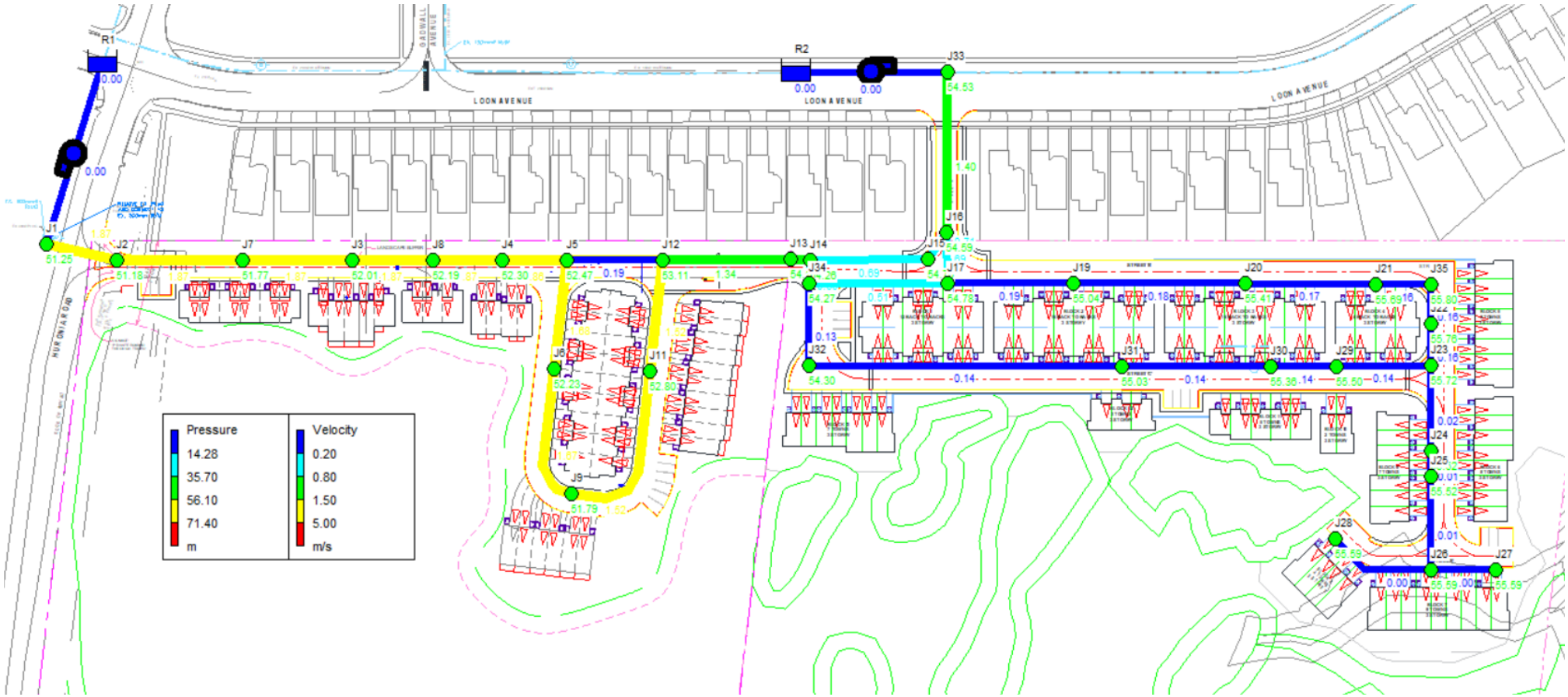
Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	79.31	2.52	41.08	Open
P4	79.01	2.51	40.79	Open
P5	101.39	3.23	64.74	Open
P6	79.31	2.52	41.08	Open
P7	79.21	2.52	40.98	Open
P8	79.12	2.52	40.90	Open
P9	79.07	2.52	40.85	Open
P2	-48.91	1.56	16.78	Open
P11	-49.18	1.57	16.95	Open
P12	-22.39	0.71	3.95	Open
P13	-71.57	2.28	33.96	Open
P14	-71.57	2.28	33.96	Open
P15	73.50	2.34	35.68	Open
P16	43.43	1.38	13.47	Open
P17	43.43	1.38	13.47	Open
P18	30.06	0.96	6.81	Open
P19	-28.13	0.90	6.03	Open
P20	16.90	0.96	11.36	Open
P21	-11.23	0.36	1.10	Open
P22	12.94	0.41	1.43	Open
P23	12.65	0.40	1.37	Open
P24	12.35	0.39	1.31	Open
P25	12.21	0.39	1.28	Open
P26	12.21	0.39	1.28	Open
P27	12.06	0.38	1.26	Open
P28	11.54	0.37	1.16	Open
P29	11.51	0.37	1.15	Open
P30	11.42	0.36	1.13	Open
P31	-11.36	0.36	1.12	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-49.01	1.56	16.85	Open
1	79.31	0.00	-301.68	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	73.50	0.00	-299.08	Open Pump

Max Day + Fire Flow Demand Conditions at External 521 Huronia Road Lands - Block 6 (J9) Schematic



Project No: 21076
January 2022

Prepared by: JL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*************************************************************************
*                          E P A N E T                                  *
*                    Hydraulic and Water Quality                        *
*                    Analysis for Pipe Networks                         *
*                         Version 2.2                                   *
*************************************************************************

Input File: 21076_Max Day + Fire @ Huronia Block 6.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
P1	J1	J2	22.05	200
P4	J4	J5	19.49	200
P5	J5	J6	32.42	200
P6	J2	J7	37.41	200
P7	J7	J3	32.68	200
P8	J3	J8	25.97	200
P9	J8	J4	21.27	200
P2	J6	J9	42.67	200
P11	J11	J12	34.10	200
P12	J5	J12	29.21	200
P13	J12	J13	36.04	200
P14	J13	J14	5.68	200
P15	J33	J16	49.38	200
P16	J16	J15	9.64	200
P17	J15	J14	36.09	200
P18	J16	J17	15.36	200
P19	J14	J34	6.15	200
P20	J17	J34	41.75	200
P21	J34	J32	24.90	200
P22	J17	J19	38.70	200
P23	J19	J20	52.00	200
P24	J20	J21	39.80	200
P25	J21	J35	16.95	200
P26	J35	J22	12.45	200
P27	J22	J23	12.45	200
P28	J23	J29	29.02	200
P29	J29	J30	19.84	200
P30	J30	J31	44.58	200
P31	J32	J31	95.75	200
P32	J23	J24	25.56	200
P33	J24	J25	7.60	200
P34	J25	J26	28.55	200
P35	J26	J27	19.74	200

P36	J26	J28	33.23	200
P3	J9	J11	54.61	200
1	R1	J1	#N/A	#N/A Pump
2	R2	J33	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
1	100.00	75.00	1.10	232.68	232.68	0.00
2	100.00	75.00	1.09	172.47	172.47	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.00	302.55	51.25	0.00
J2	0.00	302.03	51.18	0.00
J3	0.08	300.37	52.01	0.00
J4	0.07	299.26	52.30	0.00
J5	0.00	298.81	52.47	0.00
J6	0.30	298.18	52.23	0.00
J7	0.10	301.14	51.77	0.00
J8	0.05	299.76	52.19	0.00
J9	100.10	297.37	51.79	0.00
J11	0.17	298.25	52.80	0.00
J12	0.00	298.80	53.11	0.00
J13	0.00	299.25	54.10	0.00
J14	0.00	299.33	54.26	0.00
J15	0.00	299.46	54.70	0.00
J16	0.00	299.50	54.59	0.00
J17	0.22	299.44	54.78	0.00
J19	0.29	299.42	55.04	0.00
J20	0.29	299.41	55.41	0.00
J21	0.15	299.40	55.69	0.00
J22	0.15	299.39	55.76	0.00
J23	0.00	299.39	55.72	0.00
J24	0.15	299.39	55.52	0.00
J25	0.13	299.39	55.52	0.00
J26	0.18	299.39	55.59	0.00
J27	0.00	299.39	55.59	0.00
J28	0.05	299.39	55.59	0.00

J29	0.04	299.38	55.50	0.00	
J30	0.09	299.38	55.36	0.00	
J31	0.05	299.37	55.03	0.00	
J32	0.13	299.35	54.30	0.00	
J33	0.00	300.18	54.53	0.00	
J34	0.00	299.35	54.27	0.00	
J35	0.00	299.39	55.80	0.00	
R1	-58.84	0.00	0.00	0.00	Reservoir
R2	-43.96	0.00	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
P1	58.84	1.87	23.63	Open
P4	58.54	1.86	23.41	Open
P5	52.67	1.68	19.25	Open
P6	58.84	1.87	23.63	Open
P7	58.74	1.87	23.56	Open
P8	58.66	1.87	23.50	Open
P9	58.61	1.87	23.46	Open
P2	52.36	1.67	19.04	Open
P11	-47.90	1.52	16.15	Open
P12	5.88	0.19	0.33	Open
P13	-42.03	1.34	12.67	Open
P14	-42.03	1.34	12.67	Open
P15	43.96	1.40	13.77	Open
P16	21.70	0.69	3.73	Open
P17	21.70	0.69	3.73	Open
P18	22.26	0.71	3.90	Open
P19	-20.33	0.65	3.30	Open
P20	16.16	0.51	2.16	Open
P21	-4.16	0.13	0.17	Open
P22	5.87	0.19	0.33	Open
P23	5.58	0.18	0.30	Open
P24	5.28	0.17	0.27	Open
P25	5.14	0.16	0.26	Open
P26	5.14	0.16	0.26	Open
P27	4.99	0.16	0.24	Open
P28	4.47	0.14	0.20	Open
P29	4.44	0.14	0.20	Open
P30	4.34	0.14	0.19	Open
P31	-4.29	0.14	0.18	Open
P32	0.51	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open

P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-47.74	1.52	16.04	Open
1	58.84	0.00	-302.55	Open Pump
2	43.96	0.00	-300.18	Open Pump

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Node Results at 1:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.55	51.25	0.00	
J2	0.00	302.03	51.18	0.00	
J3	0.08	300.37	52.01	0.00	
J4	0.07	299.26	52.30	0.00	
J5	0.00	298.81	52.47	0.00	
J6	0.30	298.18	52.23	0.00	
J7	0.10	301.14	51.77	0.00	
J8	0.05	299.76	52.19	0.00	
J9	100.10	297.37	51.79	0.00	
J11	0.17	298.25	52.80	0.00	
J12	0.00	298.80	53.11	0.00	
J13	0.00	299.25	54.10	0.00	
J14	0.00	299.33	54.26	0.00	
J15	0.00	299.46	54.70	0.00	
J16	0.00	299.50	54.59	0.00	
J17	0.22	299.44	54.78	0.00	
J19	0.29	299.42	55.04	0.00	
J20	0.29	299.41	55.41	0.00	
J21	0.15	299.40	55.69	0.00	
J22	0.15	299.39	55.76	0.00	
J23	0.00	299.39	55.72	0.00	
J24	0.15	299.39	55.52	0.00	
J25	0.13	299.39	55.52	0.00	
J26	0.18	299.39	55.59	0.00	
J27	0.00	299.39	55.59	0.00	
J28	0.05	299.39	55.59	0.00	
J29	0.04	299.38	55.50	0.00	
J30	0.09	299.38	55.36	0.00	
J31	0.05	299.37	55.03	0.00	
J32	0.13	299.35	54.30	0.00	
J33	0.00	300.18	54.53	0.00	
J34	0.00	299.35	54.27	0.00	
J35	0.00	299.39	55.80	0.00	
R1	-58.84	0.00	0.00	0.00	Reservoir
R2	-43.96	0.00	0.00	0.00	Reservoir

Link Results at 1:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	58.84	1.87	23.63	Open
P4	58.54	1.86	23.41	Open
P5	52.67	1.68	19.25	Open
P6	58.84	1.87	23.63	Open
P7	58.74	1.87	23.56	Open
P8	58.66	1.87	23.50	Open

Link Results at 1:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P9	58.61	1.87	23.46	Open
P2	52.36	1.67	19.04	Open
P11	-47.90	1.52	16.15	Open
P12	5.88	0.19	0.33	Open
P13	-42.03	1.34	12.67	Open
P14	-42.03	1.34	12.67	Open
P15	43.96	1.40	13.77	Open
P16	21.70	0.69	3.73	Open
P17	21.70	0.69	3.73	Open
P18	22.26	0.71	3.90	Open
P19	-20.33	0.65	3.30	Open
P20	16.16	0.51	2.16	Open
P21	-4.16	0.13	0.17	Open
P22	5.87	0.19	0.33	Open
P23	5.58	0.18	0.30	Open
P24	5.28	0.17	0.27	Open
P25	5.14	0.16	0.26	Open
P26	5.14	0.16	0.26	Open
P27	4.99	0.16	0.25	Open
P28	4.47	0.14	0.20	Open
P29	4.44	0.14	0.20	Open
P30	4.34	0.14	0.19	Open
P31	-4.29	0.14	0.18	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-47.74	1.52	16.04	Open
1	58.84	0.00	-302.55	Open Pump
2	43.96	0.00	-300.18	Open Pump

Node Results at 2:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.55	51.25	0.00	
J2	0.00	302.03	51.18	0.00	
J3	0.08	300.37	52.01	0.00	
J4	0.07	299.26	52.30	0.00	
J5	0.00	298.81	52.47	0.00	
J6	0.30	298.18	52.23	0.00	
J7	0.10	301.14	51.77	0.00	
J8	0.05	299.76	52.19	0.00	
J9	100.10	297.37	51.79	0.00	
J11	0.17	298.25	52.80	0.00	

Node Results at 2:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J12	0.00	298.80	53.11	0.00	
J13	0.00	299.25	54.10	0.00	
J14	0.00	299.33	54.26	0.00	
J15	0.00	299.46	54.70	0.00	
J16	0.00	299.50	54.59	0.00	
J17	0.22	299.44	54.78	0.00	
J19	0.29	299.42	55.04	0.00	
J20	0.29	299.41	55.41	0.00	
J21	0.15	299.40	55.69	0.00	
J22	0.15	299.39	55.76	0.00	
J23	0.00	299.39	55.72	0.00	
J24	0.15	299.39	55.52	0.00	
J25	0.13	299.39	55.52	0.00	
J26	0.18	299.39	55.59	0.00	
J27	0.00	299.39	55.59	0.00	
J28	0.05	299.39	55.59	0.00	
J29	0.04	299.38	55.50	0.00	
J30	0.09	299.38	55.36	0.00	
J31	0.05	299.37	55.03	0.00	
J32	0.13	299.35	54.30	0.00	
J33	0.00	300.18	54.53	0.00	
J34	0.00	299.35	54.27	0.00	
J35	0.00	299.39	55.80	0.00	
R1	-58.84	0.00	0.00	0.00	Reservoir
R2	-43.96	0.00	0.00	0.00	Reservoir

Link Results at 2:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	58.84	1.87	23.63	Open
P4	58.54	1.86	23.41	Open
P5	52.67	1.68	19.25	Open
P6	58.84	1.87	23.63	Open
P7	58.74	1.87	23.56	Open
P8	58.66	1.87	23.50	Open
P9	58.61	1.87	23.46	Open
P2	52.36	1.67	19.04	Open
P11	-47.90	1.52	16.15	Open
P12	5.88	0.19	0.33	Open
P13	-42.03	1.34	12.67	Open
P14	-42.03	1.34	12.67	Open
P15	43.96	1.40	13.77	Open
P16	21.70	0.69	3.73	Open
P17	21.70	0.69	3.73	Open
P18	22.26	0.71	3.90	Open

Link Results at 2:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P19	-20.33	0.65	3.30	Open
P20	16.16	0.51	2.16	Open
P21	-4.16	0.13	0.17	Open
P22	5.87	0.19	0.33	Open
P23	5.58	0.18	0.30	Open
P24	5.28	0.17	0.27	Open
P25	5.14	0.16	0.26	Open
P26	5.14	0.16	0.26	Open
P27	4.99	0.16	0.25	Open
P28	4.47	0.14	0.20	Open
P29	4.44	0.14	0.20	Open
P30	4.34	0.14	0.19	Open
P31	-4.29	0.14	0.18	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-47.74	1.52	16.04	Open
1	58.84	0.00	-302.55	Open Pump
2	43.96	0.00	-300.18	Open Pump

Node Results at 3:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.55	51.25	0.00	
J2	0.00	302.03	51.18	0.00	
J3	0.08	300.37	52.01	0.00	
J4	0.07	299.26	52.30	0.00	
J5	0.00	298.81	52.47	0.00	
J6	0.30	298.18	52.23	0.00	
J7	0.10	301.14	51.77	0.00	
J8	0.05	299.76	52.19	0.00	
J9	100.10	297.37	51.79	0.00	
J11	0.17	298.25	52.80	0.00	
J12	0.00	298.80	53.11	0.00	
J13	0.00	299.25	54.10	0.00	
J14	0.00	299.33	54.26	0.00	
J15	0.00	299.46	54.70	0.00	
J16	0.00	299.50	54.59	0.00	
J17	0.22	299.44	54.78	0.00	
J19	0.29	299.42	55.04	0.00	
J20	0.29	299.41	55.41	0.00	
J21	0.15	299.40	55.69	0.00	
J22	0.15	299.39	55.76	0.00	

Node Results at 3:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J23	0.00	299.39	55.72	0.00	
J24	0.15	299.39	55.52	0.00	
J25	0.13	299.39	55.52	0.00	
J26	0.18	299.39	55.59	0.00	
J27	0.00	299.39	55.59	0.00	
J28	0.05	299.39	55.59	0.00	
J29	0.04	299.38	55.50	0.00	
J30	0.09	299.38	55.36	0.00	
J31	0.05	299.37	55.03	0.00	
J32	0.13	299.35	54.30	0.00	
J33	0.00	300.18	54.53	0.00	
J34	0.00	299.35	54.27	0.00	
J35	0.00	299.39	55.80	0.00	
R1	-58.84	0.00	0.00	0.00	Reservoir
R2	-43.96	0.00	0.00	0.00	Reservoir

Link Results at 3:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	58.84	1.87	23.63	Open
P4	58.54	1.86	23.41	Open
P5	52.67	1.68	19.25	Open
P6	58.84	1.87	23.63	Open
P7	58.74	1.87	23.56	Open
P8	58.66	1.87	23.50	Open
P9	58.61	1.87	23.46	Open
P2	52.36	1.67	19.04	Open
P11	-47.90	1.52	16.15	Open
P12	5.88	0.19	0.33	Open
P13	-42.03	1.34	12.67	Open
P14	-42.03	1.34	12.67	Open
P15	43.96	1.40	13.77	Open
P16	21.70	0.69	3.73	Open
P17	21.70	0.69	3.73	Open
P18	22.26	0.71	3.90	Open
P19	-20.33	0.65	3.30	Open
P20	16.16	0.51	2.16	Open
P21	-4.16	0.13	0.17	Open
P22	5.87	0.19	0.33	Open
P23	5.58	0.18	0.30	Open
P24	5.28	0.17	0.27	Open
P25	5.14	0.16	0.26	Open
P26	5.14	0.16	0.26	Open
P27	4.99	0.16	0.24	Open
P28	4.47	0.14	0.20	Open

Link Results at 3:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P29	4.44	0.14	0.20	Open
P30	4.34	0.14	0.19	Open
P31	-4.29	0.14	0.18	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-47.74	1.52	16.04	Open
1	58.84	0.00	-302.55	Open Pump
2	43.96	0.00	-300.18	Open Pump

Node Results at 4:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J1	0.00	302.55	51.25	0.00	
J2	0.00	302.03	51.18	0.00	
J3	0.08	300.37	52.01	0.00	
J4	0.07	299.26	52.30	0.00	
J5	0.00	298.81	52.47	0.00	
J6	0.30	298.18	52.23	0.00	
J7	0.10	301.14	51.77	0.00	
J8	0.05	299.76	52.19	0.00	
J9	100.10	297.37	51.79	0.00	
J11	0.17	298.25	52.80	0.00	
J12	0.00	298.80	53.11	0.00	
J13	0.00	299.25	54.10	0.00	
J14	0.00	299.33	54.26	0.00	
J15	0.00	299.46	54.70	0.00	
J16	0.00	299.50	54.59	0.00	
J17	0.22	299.44	54.78	0.00	
J19	0.29	299.42	55.04	0.00	
J20	0.29	299.41	55.41	0.00	
J21	0.15	299.40	55.69	0.00	
J22	0.15	299.39	55.76	0.00	
J23	0.00	299.39	55.72	0.00	
J24	0.15	299.39	55.52	0.00	
J25	0.13	299.39	55.52	0.00	
J26	0.18	299.39	55.59	0.00	
J27	0.00	299.39	55.59	0.00	
J28	0.05	299.39	55.59	0.00	
J29	0.04	299.38	55.50	0.00	
J30	0.09	299.38	55.36	0.00	
J31	0.05	299.37	55.03	0.00	
J32	0.13	299.35	54.30	0.00	

Node Results at 4:00 Hrs: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
J33	0.00	300.18	54.53	0.00	
J34	0.00	299.35	54.27	0.00	
J35	0.00	299.39	55.80	0.00	
R1	-58.84	0.00	0.00	0.00	Reservoir
R2	-43.96	0.00	0.00	0.00	Reservoir

Link Results at 4:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	58.84	1.87	23.63	Open
P4	58.54	1.86	23.41	Open
P5	52.67	1.68	19.25	Open
P6	58.84	1.87	23.63	Open
P7	58.74	1.87	23.56	Open
P8	58.66	1.87	23.50	Open
P9	58.61	1.87	23.46	Open
P2	52.36	1.67	19.04	Open
P11	-47.90	1.52	16.15	Open
P12	5.88	0.19	0.33	Open
P13	-42.03	1.34	12.67	Open
P14	-42.03	1.34	12.67	Open
P15	43.96	1.40	13.77	Open
P16	21.70	0.69	3.73	Open
P17	21.70	0.69	3.73	Open
P18	22.26	0.71	3.90	Open
P19	-20.33	0.65	3.30	Open
P20	16.16	0.51	2.16	Open
P21	-4.16	0.13	0.17	Open
P22	5.87	0.19	0.33	Open
P23	5.58	0.18	0.30	Open
P24	5.28	0.17	0.27	Open
P25	5.14	0.16	0.26	Open
P26	5.14	0.16	0.26	Open
P27	4.99	0.16	0.24	Open
P28	4.47	0.14	0.20	Open
P29	4.44	0.14	0.20	Open
P30	4.34	0.14	0.19	Open
P31	-4.29	0.14	0.18	Open
P32	0.52	0.02	0.00	Open
P33	0.37	0.01	0.00	Open
P34	0.24	0.01	0.00	Open
P35	0.00	0.00	0.00	Open
P36	0.05	0.00	0.00	Open
P3	-47.74	1.52	16.04	Open
1	58.84	0.00	-302.55	Open Pump

Link Results at 4:00 Hrs: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
2	43.96	0.00	-300.18	Open Pump

Appendix A2

Hydrant Flow Test Results

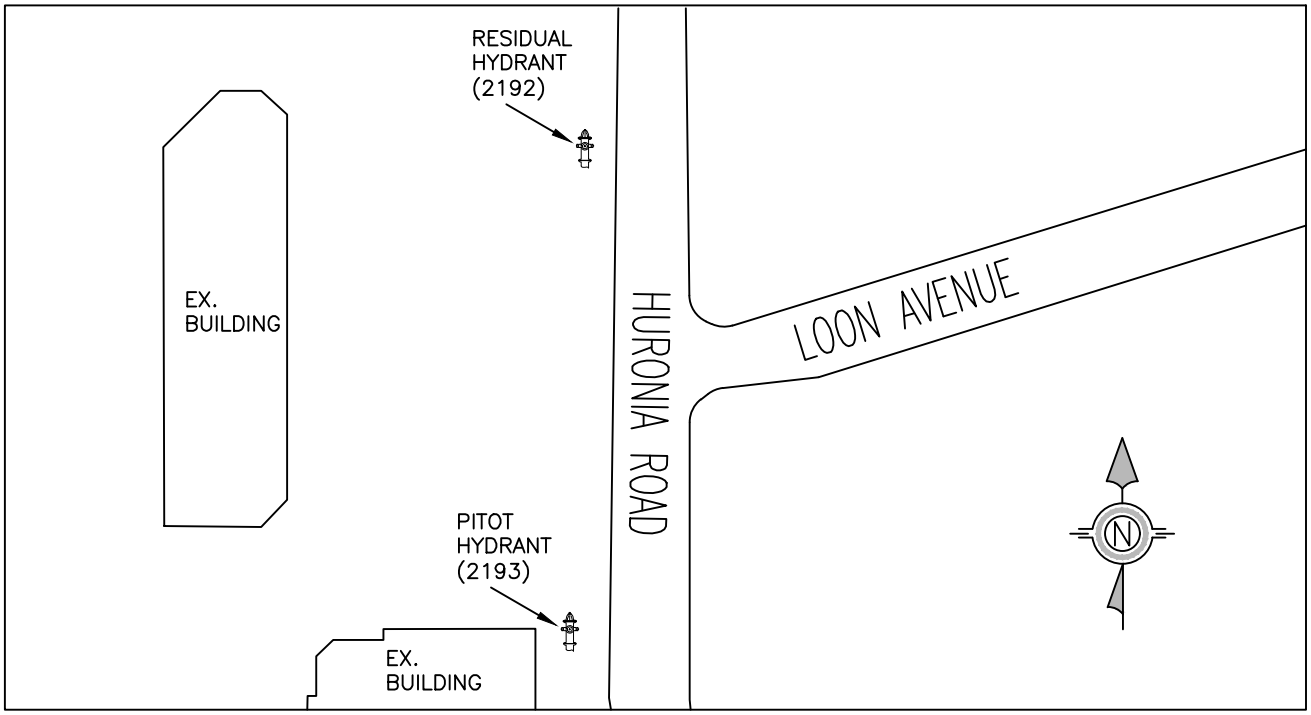
FLOW TEST RESULTS

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945

DATE : THURSDAY NOVEMBER 12, 2020 TIME : 3:00 PM

LOCATION : HURONIA ROAD & LOON AVENUE
BARRIE
ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 70 PSI

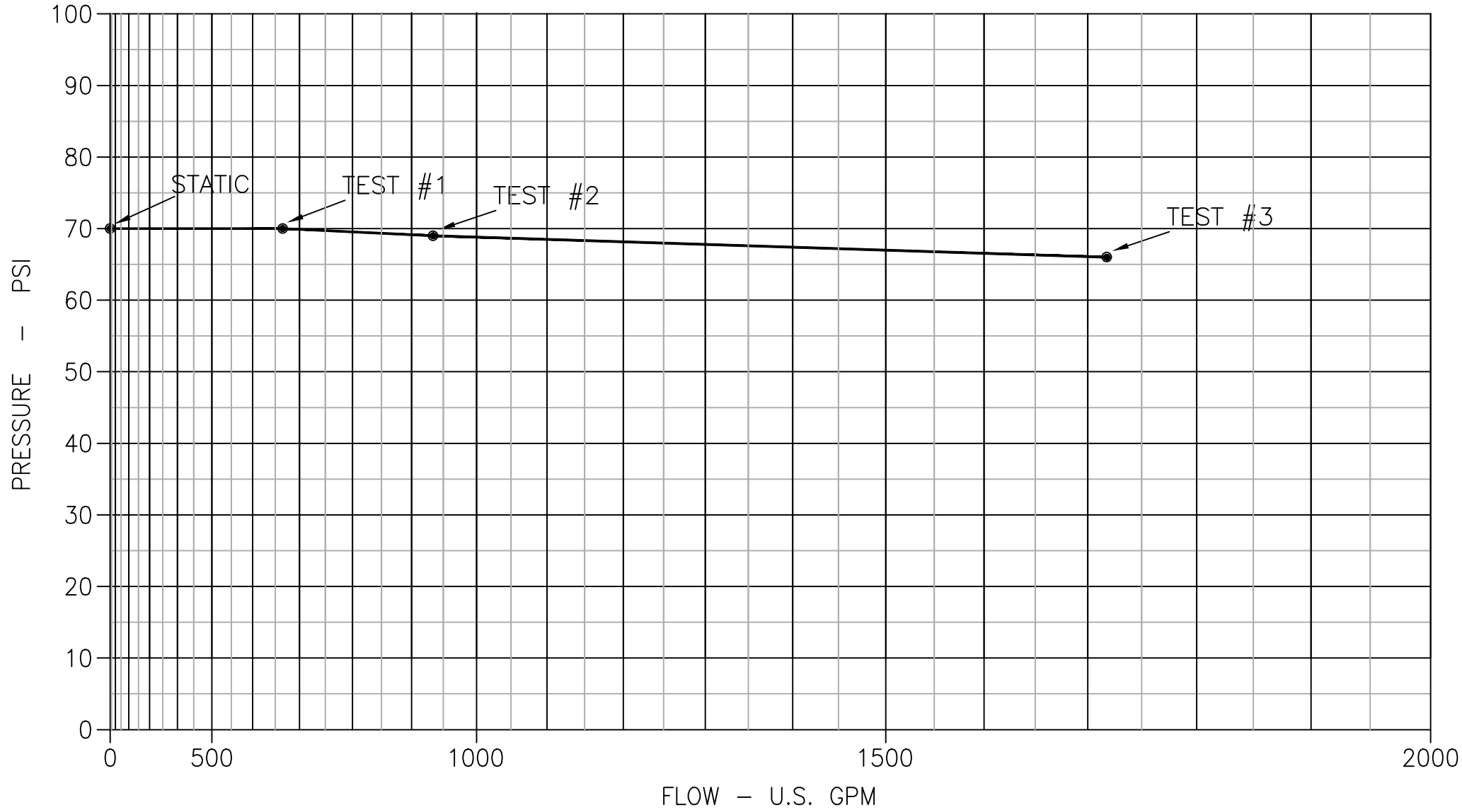
TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1-3/4	0.995	70	55	660
2	1	2-1/2	0.9	69	31	939
3	2	2-1/2	0.9	66	26	1720

FIRST FOR FIRE, LIFE SAFETY & SECURITY

VIPOND INC est. 1945

HURONIA ROAD & LOON AVENUE	BY : GUS A.
BARRIE	OFFICE : BARRIE
ONTARIO	TEST BY : VIPOND & PUC
	DATE : NOVEMBER 12, 2020

STATIC:	RESIDUAL:		FLOW:	
70 PSI	TEST#1	70 PSI	@	660 GPM
	TEST#2	69 PSI	@	939 GPM
	TEST#3	66 PSI	@	1720 GPM



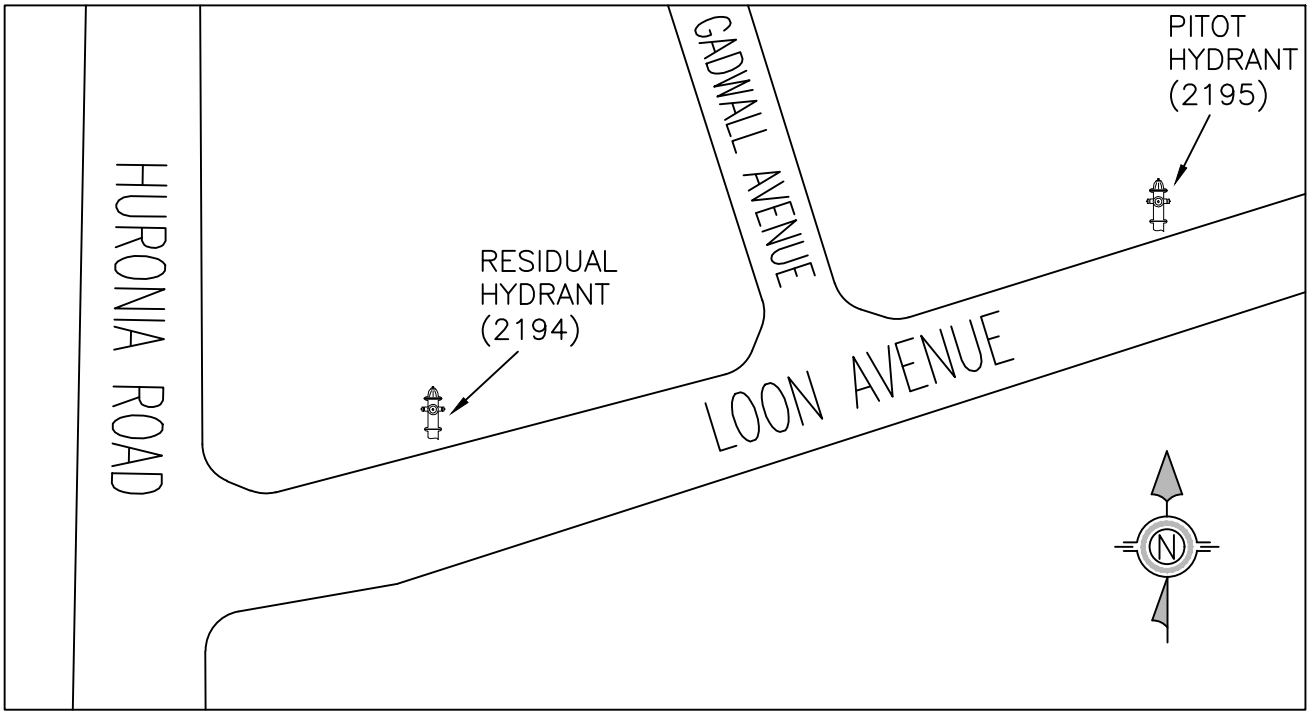
FLOW TEST RESULTS

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945

DATE : THURSDAY NOVEMBER 12, 2020 TIME : 2:30 PM

LOCATION : LOON AVENUE & GADWALL AVENUE
BARRIE
ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 73 PSI

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1-3/4	0.995	72	57	672
2	1	2-1/2	0.9	71	35	998
3	2	2-1/2	0.9	68	28	1786

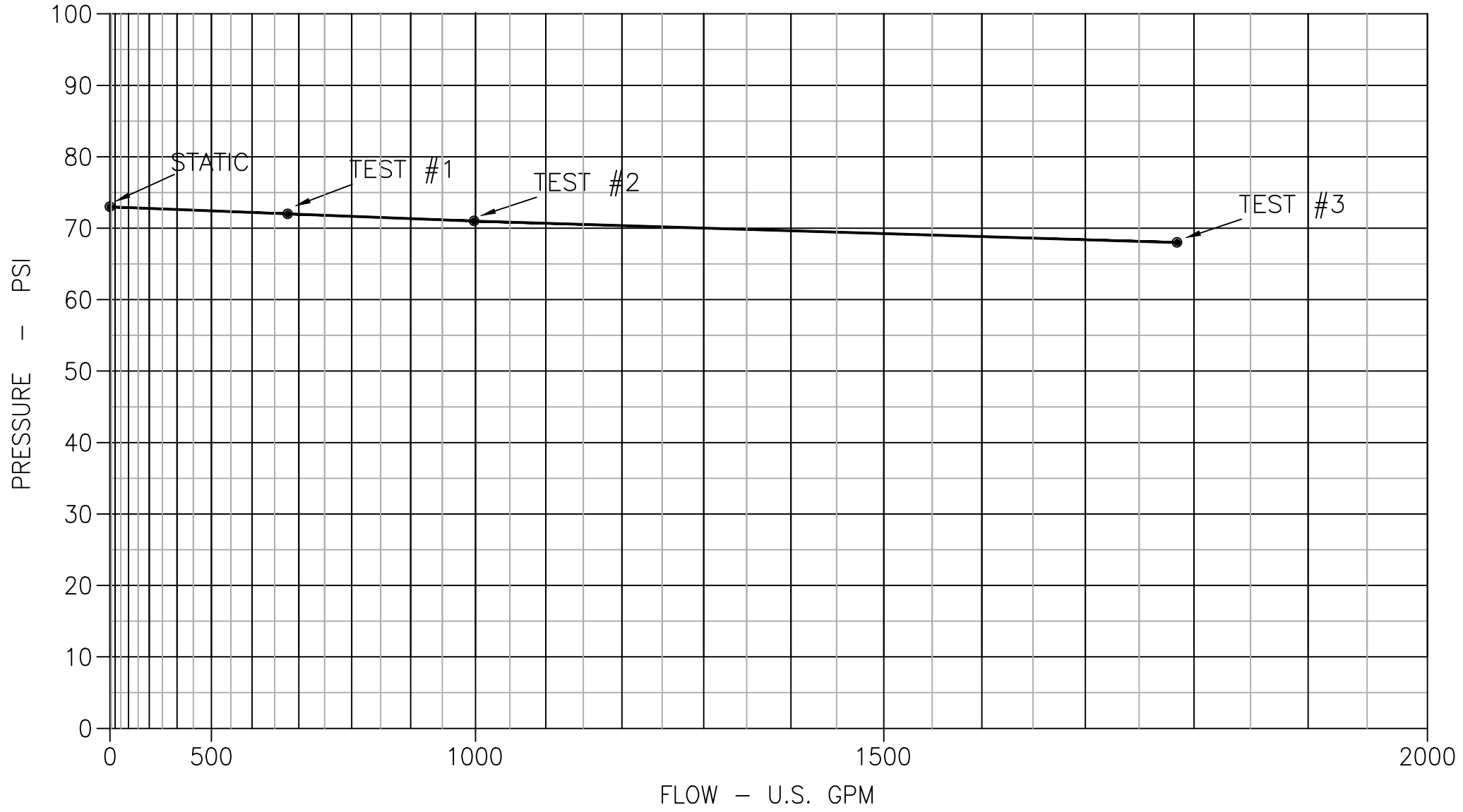
FIRST FOR FIRE, LIFE SAFETY & SECURITY

VIPOND INC

est. 1945

LOON AVENUE & GADWALL AVENUE	BY : GUS A.
BARRIE	OFFICE : BARRIE
ONTARIO	TEST BY : VIPOND & PUC
	DATE : NOVEMBER 12, 2020

STATIC:	RESIDUAL:		FLOW:
73 PSI	TEST#1 72 PSI	@	672 GPM
	TEST#2 71 PSI	@	998 GPM
	TEST#3 68 PSI	@	1786 GPM



Appendix B

Sanitary Design Flow Calculations

Counterpoint Engineering Inc.

Project: 340 Mapleview Drive
Project No: 21076
Location: Barrie, Ontario
Site Area: 1.89 ha
(Area within limit of wetland)

Proposed Sanitary Flow Calculations

As per Sanitary Sewage Collection System Policies and Design Guidelines, City of Barrie, 2017

Design flow = (Population in Thousands x Average Daily Flow x Peaking Factor)/86.4 + (Infiltration Rate x Area)

Persons Per Unit and per Land Use

Low Density (Single detached, etc.)	3.13	ppu
Medium Density (Townhouse, etc.)	2.34	ppu
High Density (Apartment, etc.)	1.67	ppu
Commercial / Retail	1.1	persons/100m^2
Offices	3.3	persons/100m^2

	Residential Units		Retail
	Townhouse	Total Units	Area (m^2)
TOTAL UNITS / AREA (m^2)	**105**	**105**	**-**

	Population 1BR / 1B + D	TOTAL POPULATION
Residential	246	246
Commercial	-	n/a
Total Equivalent Population		**246**

Peak Flow Design Parameters

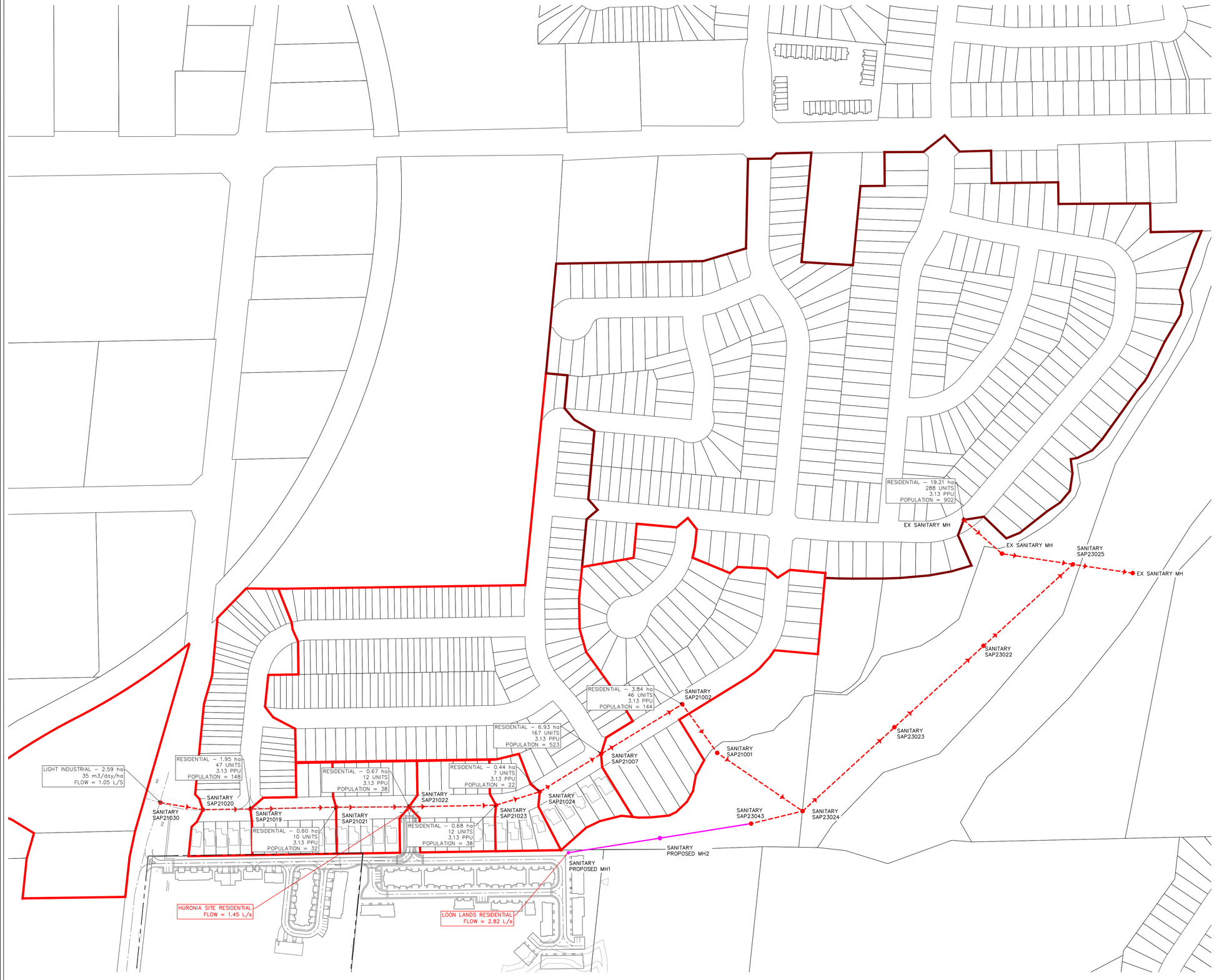
Residential Average flow	225	litres/person/day
Commercial Average flow	28	m^3/day/ha
Infiltration	0.1	litres/second/ha

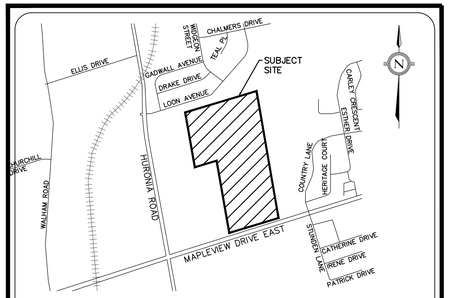
Harmon Peaking Factor

PF = 1 + (14/(4+(P/1000)$^{1/2}$))

Residential Population	Harmon Peak Factor
246	**4.11**

Residential Flow	2.64	**l/s**
Commercial Flow	-	**l/s**
Infiltration	0.19	**l/s**
Groundwater Flows	0.00	**l/s**
Flow	**2.82**	**l/s**





KEY PLAN

LEGEND

- SANITARY DRAINAGE BOUNDARY NORTH
- SANITARY DRAINAGE BOUNDARY SOUTH
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER

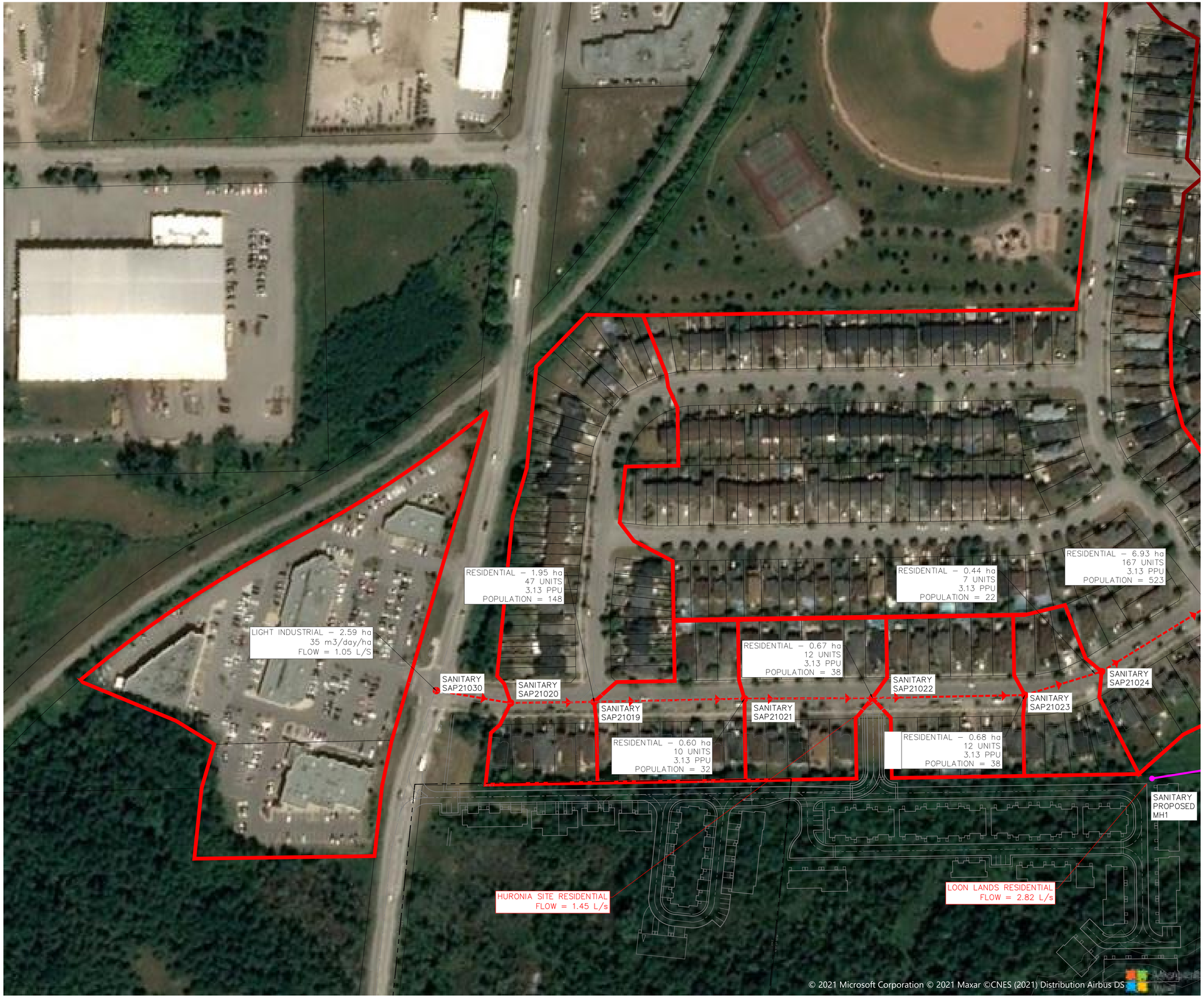
counterpoint ENGINEERING
COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

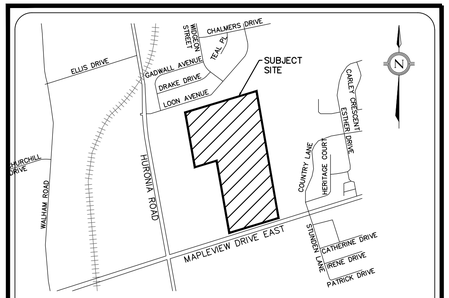
SITE LOCATION:
340 MAPLEVIEW DRIVE
PROPOSED TOWNHOME COMMUNITY
BARRIE, ONTARIO

SANITARY DRAINAGE ANALYSIS

DESIGNED BY: S.C	CHECKED BY: K.R	DATE: DEC 2021
DRAWING BY: S.C	CHECKED BY: K.R	PROJECT NO. 21076
SCALE: 1:1750m (0m 35m 70m 105m)		DRAWING NO. SAN-1

REGION FILE No.:





KEY PLAN

LEGEND

- SANITARY DRAINAGE BOUNDARY NORTH
- SANITARY DRAINAGE BOUNDARY SOUTH
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER

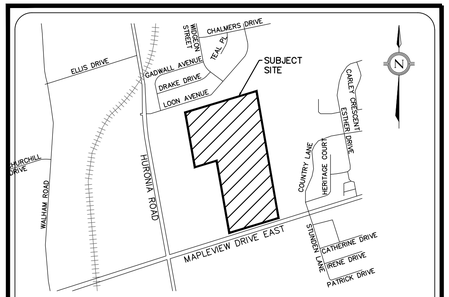
counterpoint ENGINEERING
COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

SITE LOCATION:
340 MAPLEVIEW DRIVE
PROPOSED TOWNHOME COMMUNITY
BARRIE, ONTARIO

SANITARY DRAINAGE ANALYSIS

DESIGNED BY: S.C	CHECKED BY: K.R	DATE: DEC 2021
DRAWING BY: S.C	CHECKED BY: K.R	PROJECT NO. 21076
SCALE: 1:1000m 0m 20m 40m 60m		DRAWING NO. SAN-2

REGION FILE No.:



KEY PLAN

LEGEND

- SANITARY DRAINAGE BOUNDARY NORTH
- SANITARY DRAINAGE BOUNDARY SOUTH
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER

counterpoint ENGINEERING
COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

SITE LOCATION:

340 MAPLEVIEW DRIVE
PROPOSED TOWNHOME COMMUNITY
BARRIE, ONTARIO

SANITARY DRAINAGE ANALYSIS

DESIGNED BY: S.C	CHECKED BY: K.R	DATE: DEC 2021
DRAWING BY: S.C	CHECKED BY: K.R	PROJECT NO. 21076
SCALE: 1:1000m (0m 20m 40m 60m)		DRAWING NO. SAN–3

REGION FILE No.:

SANITARY SEWER DESIGN

Development Details Basis

DESIGN SHEET _____
FILE NO _____
CONTRACT / PROJECT _____

n ≥ 0.013
M = 5/P^0.2 Babbit

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.
$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)
$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	DWELL UNITS	DWELL (ACC) UNITS	DENSITY P.P.U.	POP. (P)	POP. (ACC)	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p[6] (l/s)	AREA (ha)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S[5] (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.85	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
Commercial					.						1.05													
Loon Avenue	SAP21030	SAP21020	0	0	3.13	0	0	4.000	4.491	4.491	1.051	0.00	0.00	0.00	1.051	43.0	250	1.07%	61.514	0.090	Ok	1.253	0.470	Check
Loon Avenue	SAP21020	SAP21019	148	148	3.13	464	464	4.000	3.991	4.000	5.884	1.95	1.95	0.20	6.079	47.0	250	3.64%	113.457	0.157	Ok	2.311	1.214	Ok
Loon Avenue	SAP21019	SAP21021	10	158	3.13	32	496	4.000	3.976	4.000	6.218	0.60	2.55	0.26	6.473	84.8	250	3.00%	103.001	0.169	Ok	2.098	1.154	Ok
Loon Avenue	SAP21021	SAP21022	12	170	3.13	38	534	4.000	3.959	4.000	6.614	0.67	3.22	0.32	6.936	73.3	250	2.00%	84.100	0.194	Ok	1.713	1.019	Ok
Huronia Site											1.050													
Loon Avenue	SAP21022	SAP21023	12	182	3.13	38	572	4.000	3.943	4.000	8.459	0.68	3.90	0.39	8.849	86.7	250	0.50%	42.050	0.311	Ok	0.857	0.670	Ok
Loon Avenue	SAP21023	SAP21024	7	189	3.13	22	594	4.000	3.935	4.000	8.689	0.44	4.34	0.43	9.123	44.9	250	0.50%	42.050	0.316	Ok	0.857	0.674	Ok
Loon Avenue	SAP21024	SAP21007	167	356	3.13	523	1117	4.000	3.768	4.000	14.136	6.93	11.27	1.13	15.263	71.6	250	0.50%	42.050	0.416	Ok	0.857	0.772	Ok
Loon Avenue	SAP21007	SAP21002	46	402	3.13	144	1261	4.000	3.733	4.000	15.636	3.84	15.11	1.51	17.147	94.5	250	0.46%	40.333	0.455	Ok	0.822	0.769	Ok
Easement	SAP21002	SAP21001	0	0	3.13	0	1261	4.000	3.733	4.000	15.638	0.00	15.11	1.51	17.149	60.9	250	2.00%	84.100	0.306	Ok	1.713	1.310	Ok
Easement	SAP21001	SAP23024	0	0	3.13	0	1261	4.000	3.733	4.000	15.639	0.00	15.11	1.51	17.150	103.8	250	2.00%	84.100	0.306	Ok	1.713	1.310	Ok
Loon Lands Site	Ex. Land										0.000	1.89	17.00	1.70	0.000	92.0	250	0.48%	41.200	#N/A	#N/A	0.839	#N/A	#N/A
Easement	SAP23043	SAP23024									0.000	0.00	17.00	1.70	0.000	52.5	250	0.50%	42.050	#N/A	#N/A	0.857	#N/A	#N/A
Easement	SAP23024	SAP23023	0	0	3.13	0	1261	4.000	3.733	4.000	15.640	0.00	32.11	3.21	18.851	121.9	250	0.38%	36.658	0.508	Check	0.747	0.717	Ok
Easement	SAP23023	SAP23022	0	0	3.13	0	1262	4.000	3.733	4.000	15.641	0.00	32.11	3.21	18.852	120.1	250	0.36%	35.681	0.516	Check	0.727	0.703	Ok
Easement	SAP23022	SAP23025	0	0	3.13	0	1262	4.000	3.733	4.000	15.642	0.00	32.11	3.21	18.853	121.5	250	0.38%	36.658	0.508	Check	0.747	0.717	Ok
Chalmers Drive	EX SAN MH	EX SAN MH	288	288	3.13	902	902	4.000	3.828	4.000	9.396	19.21	19.21	1.92	11.317	50.6	250	0.40%	37.611	0.376	Ok	0.766	0.636	Ok
Easement	EX SAN MH	SAP23025	0	288	3.13	0	902	4.000	3.828	4.000	9.397	0.00	19.21	1.92	11.318	70.6	250	0.40%	37.611	0.376	Ok	0.766	0.636	Ok
Easement	SAP23025	EX SAN MH	0	0	3.13	0	2164	4.000	3.559	4.000	25.040	0.00	51.32	5.13	30.172	63.7	250	0.40%	37.611	0.677	Check	0.766	0.820	Ok

DATE: CALCULATED BY: CHECKED BY:

Notes:
(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.85 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity
(5) Slopes highlighted yellow are unknown and assumed as the minimum allowable slope
(6) Peak flows highleted red are inputs from proposed developments

SANITARY SEWER DESIGN

Development Details Basis

DESIGN SHEET _____
FILE NO _____
CONTRACT / PROJECT _____

n ≥ 0.013
M = 5/P^0.2 Babbit
Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.
$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)
$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	DWELL UNITS	DWELL (ACC) UNITS	DENSITY P.P.U.	POP. (P)	POP. (ACC)	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p[6] (l/s)	AREA (ha)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S[5] (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.85	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
Commercial					.						**1.05**													
Loon Avenue	SAP21030	SAP21020	0	0	3.13	0	0	4.000	4.491	4.491	1.051	0.00	0.00	0.00	1.051	43.0	250	1.07%	61.514	0.090	Ok	1.253	0.470	Check
Loon Avenue	SAP21020	SAP21019	148	148	3.13	464	464	4.000	3.991	4.000	5.884	1.95	1.95	0.20	6.079	47.0	250	3.64%	113.457	0.157	Ok	2.311	1.214	Ok
Loon Avenue	SAP21019	SAP21021	10	158	3.13	32	496	4.000	3.976	4.000	6.218	0.60	2.55	0.26	6.473	84.8	250	3.00%	103.001	0.169	Ok	2.098	1.154	Ok
Loon Avenue	SAP21021	SAP21022	12	170	3.13	38	534	4.000	3.959	4.000	6.614	0.67	3.22	0.32	6.936	73.3	250	2.00%	84.100	0.194	Ok	1.713	1.019	Ok
Huronia Site											1.050													
Loon Avenue	SAP21022	SAP21023	12	182	3.13	38	572	4.000	3.943	4.000	8.459	0.68	3.90	0.39	8.849	86.7	250	0.50%	42.050	0.311	Ok	0.857	0.670	Ok
Loon Avenue	SAP21023	SAP21024	7	189	3.13	22	594	4.000	3.935	4.000	8.689	0.44	4.34	0.43	9.123	44.9	250	0.50%	42.050	0.316	Ok	0.857	0.674	Ok
Loon Avenue	SAP21024	SAP21007	167	356	3.13	523	1117	4.000	3.768	4.000	14.136	6.93	11.27	1.13	15.263	71.6	250	0.50%	42.050	0.416	Ok	0.857	0.772	Ok
Loon Avenue	SAP21007	SAP21002	46	402	3.13	144	1261	4.000	3.733	4.000	15.636	3.84	15.11	1.51	17.147	94.5	250	0.46%	40.333	0.455	Ok	0.822	0.769	Ok
Easement	SAP21002	SAP21001	0	0	3.13	0	1261	4.000	3.733	4.000	15.638	0.00	15.11	1.51	17.149	60.9	250	2.00%	84.100	0.306	Ok	1.713	1.310	Ok
Easement	SAP21001	SAP23024	0	0	3.13	0	1261	4.000	3.733	4.000	15.639	0.00	15.11	1.51	17.150	103.8	250	2.00%	84.100	0.306	Ok	1.713	1.310	Ok
Loon Lands Site	ROPOSED MH1	PROPOSED MH2									2.820	1.89	17.00	1.70	2.820	92.0	250	0.48%	41.200	0.177	Ok	0.839	0.480	Check
Easement	ROPOSED MH2	SAP23043									2.820	0.00	17.00	1.70	2.820	92.0	250	0.48%	41.200	0.177	Ok	0.839	0.480	Check
Easement	SAP23043	SAP23024									2.820	0.00	17.00	1.70	2.820	52.5	250	0.50%	42.050	0.175	Ok	0.857	0.486	Check
Easement	SAP23024	SAP23023	0	0	3.13	0	1261	4.000	3.733	4.000	18.460	0.00	32.11	3.21	21.671	121.9	250	0.38%	36.658	0.553	Check	0.747	0.748	Ok
Easement	SAP23023	SAP23022	0	0	3.13	0	1262	4.000	3.733	4.000	18.461	0.00	32.11	3.21	21.672	120.1	250	0.36%	35.681	0.562	Check	0.727	0.733	Ok
Easement	SAP23022	SAP23025	0	0	3.13	0	1262	4.000	3.733	4.000	18.462	0.00	32.11	3.21	21.673	121.5	250	0.38%	36.658	0.553	Check	0.747	0.748	Ok
Chalmers Drive	EX SAN MH	EX SAN MH	288	288	3.13	902	902	4.000	3.828	4.000	9.396	19.21	19.21	1.92	11.317	50.6	250	0.40%	37.611	0.376	Ok	0.766	0.636	Ok
Easement	EX SAN MH	SAP23025	0	288	3.13	0	902	4.000	3.828	4.000	9.397	0.00	19.21	1.92	11.318	70.6	250	0.40%	37.611	0.376	Ok	0.766	0.636	Ok
Easement	SAP23025	EX SAN MH	0	0	3.13	0	2164	4.000	3.559	4.000	27.860	0.00	51.32	5.13	32.992	63.7	250	0.40%	37.611	0.726	Check	0.766	0.839	Ok

DATE: CALCULATED BY: CHECKED BY:

Notes:
(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.85 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity
(5) Slopes highlighted yellow are unknown and assumed as the minimum allowable slope
(6) Peak flows highleted red are inputs from proposed developments

Appendix C

Stormwater Management Design Calculations

Quantity Control

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SWM DESIGN CALCULATIONS
DRAINAGE AREAS AND RUNOFF COEFFICIENT CALCULATIONS

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Adjustment Ratio:	1	1.1	1.2	1.25
Runoff Coefficients:	**1 to 10-year**	**25-year**	**50-year**	**100-year**
Landscaped/Grass:	0.20	0.22	0.24	0.25
Pavement:	0.95	1.00	1.00	1.00
Roof:	0.95	1.00	1.00	1.00

Runoff Coefficients based on City of Barrie/MTO Design Standards

PRE DEVELOPMENT CONDITIONS

Area 101:

Storm Event:	Grass (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)	Runoff Coefficient
2 to 10-year:	25623	0	0	25623	2.56	0.20
25-year:	25623	0	0	25623	2.56	0.22
50-year:	25623	0	0	25623	2.56	0.24
100-year:	25623	0	0	25623	2.56	0.25

POST DEVELOPMENT CONDITIONS

Area 201:

Storm Event:	Grass (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)	Runoff Coefficient
2 to 10-year:	2280	6783	4637	13700	1.37	0.83
25-year:	2280	6783	4637	13700	1.37	0.87
50-year:	2280	6783	4637	13700	1.37	0.87
100-year:	2280	6783	4637	13700	1.37	0.88

Area 202:

Storm Event:	Grass (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)	Runoff Coefficient
2 to 10-year:	10240	0	1683	11923	1.19	0.31
25-year:	10240	0	1683	11923	1.19	0.33
50-year:	10240	0	1683	11923	1.19	0.35
100-year:	10240	0	1683	11923	1.19	0.36

Post-Development Imperviousness:

Grass (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)	Imperviousness
0.00	1.00	1.00			
12520	6783	6320	25623	2.56	0.51

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SWM DESIGN CALCULATIONS
Pre-Development 100-Year Flow Rate Calculations

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1426.408
Event	100-year	b	5.273
		c	0.759

Site Data

Area (ha)	2.56
Runoff Coefficient	0.25
AC	0.64
Tc (min)	10
Rainfall Intensity (mm/hr)	180
Rational Flow Rate (l/s)	**321**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coef
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Storage Calculations for 100-Year Storm Event for Area 201

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1426.408
Event	100-year	b	5.273
		c	0.759

Site Data

Area (ha)	1.37
Runoff Coefficient	0.88
AC	1.20
Tc (min)	10
Time Increment (min)	5
Release Rate (l/s)	110
Storage Required (m^3)	**370**

= 321 - 213

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)
10	180	0.60	360	66	294
15	145	0.48	436	99	337
20	123	0.41	492	132	360
25	107	0.36	536	165	371
30	95	0.32	573	198	375
35	86	0.29	604	231	373
40	79	0.26	632	264	368
45	73	0.24	656	297	359
50	68	0.23	679	330	349
55	64	0.21	699	363	336
60	60	0.20	718	396	322
65	57	0.19	735	429	306
70	54	0.18	752	462	290
75	51	0.17	767	495	272
80	49	0.16	781	528	253
85	47	0.16	795	561	234
90	45	0.15	808	594	214
95	43	0.14	821	627	194
100	42	0.14	832	660	172
105	40	0.13	844	693	151
110	39	0.13	855	726	129
115	38	0.13	865	759	106
120	36	0.12	875	792	83

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SWM DESIGN CALCULATIONS
Post-Development 100-Year Flow Rate Calculations for Area 202 (Uncontrolled)

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1426.408
Event	100-year	b	5.273
		c	0.759

Site Data

Area (ha)	1.19
Runoff Coefficient	0.36
AC	0.42
Tc (min)	10
Rainfall Intensity (mm/hr)	180
Rational Flow Rate (l/s)	**213**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Pre-Development 2-Year Flow Rate Calculations

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	678.085
Event	2-year	b	4.699
		c	0.781

Site Data

Area (ha)	2.56
Runoff Coefficient	0.20
AC	0.51
Tc (min)	10
Rainfall Intensity (mm/hr)	83
Rational Flow Rate (l/s)	**118**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Post-Development 2-Year Flow Rate Calculations for Area 202 (Uncontrolled)

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	678.085
Event	2-year	b	4.699
		c	0.781

Site Data

Area (ha)	1.19
Runoff Coefficient	0.31
AC	0.36
Tc (min)	10
Rainfall Intensity (mm/hr)	83
Rational Flow Rate (l/s)	**84**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Storage Calculations for 2-Year Storm Event for Area 201

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	678.085
Event	2-year	b	4.699
		c	0.781

Site Data

Area (ha)	1.37
Runoff Coefficient	0.83
AC	1.13
Tc (min)	10
Time Increment (min)	5
Release Rate (l/s)	34
Storage Required (m^3)	**181**

= 118 - 84

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	83	0.26	157	20	136	
15	66	0.21	187	31	156	
20	55	0.17	209	41	168	
25	48	0.15	226	51	175	
30	42	0.13	240	61	179	
35	38	0.12	252	72	181	
40	35	0.11	263	82	181	********
45	32	0.10	272	92	180	
50	30	0.09	281	102	178	
55	28	0.09	288	113	176	
60	26	0.08	296	123	173	
65	25	0.08	302	133	169	
70	23	0.07	308	143	165	
75	22	0.07	314	154	160	
80	21	0.07	319	164	155	
85	20	0.06	324	174	150	
90	19	0.06	329	184	145	
95	19	0.06	334	195	139	
100	18	0.06	338	205	133	
105	17	0.05	342	215	127	
110	17	0.05	346	225	121	
115	16	0.05	350	236	115	
120	16	0.05	354	246	108	

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SWM DESIGN CALCULATIONS
Pre-Development 5-Year Flow Rate Calculations

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	853.608
Event	5-year	b	4.699
		c	0.766

Site Data

Area (ha)	2.56
Runoff Coefficient	0.20
AC	0.51
Tc (min)	10
Rainfall Intensity (mm/hr)	109
Rational Flow Rate (l/s)	**155**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Storage Calculations for 5-Year Storm Event for Area 201

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	853.608
Event	5-year	b	4.699
		c	0.766

Site Data

Area (ha)	1.37
Runoff Coefficient	0.83
AC	1.13
Tc (min)	10
Time Increment (min)	5
Release Rate (l/s)	45
Storage Required (m^3)	**243**

= 155 - 110

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	109	0.34	205	27	179	
15	87	0.27	246	40	206	
20	73	0.23	276	54	222	
25	64	0.20	300	67	232	
30	56	0.18	319	81	239	
35	51	0.16	336	94	242	
40	46	0.15	350	107	243	********
45	43	0.13	364	121	243	
50	40	0.13	375	134	241	
55	37	0.12	386	148	238	
60	35	0.11	396	161	235	
65	33	0.10	405	175	231	
70	31	0.10	414	188	226	
75	30	0.09	422	201	221	
80	28	0.09	430	215	215	
85	27	0.09	437	228	209	
90	26	0.08	444	242	202	
95	25	0.08	450	255	195	
100	24	0.08	457	268	188	
105	23	0.07	463	282	181	
110	23	0.07	468	295	173	
115	22	0.07	474	309	165	
120	21	0.07	479	322	157	

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SWM DESIGN CALCULATIONS
Post-Development 5-Year Flow Rate Calculations for Area 202 (Uncontrolled)

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	853.608
Event	5-year	b	4.699
		c	0.766

Site Data

Area (ha)	1.19
Runoff Coefficient	0.31
AC	0.36
Tc (min)	10
Rainfall Intensity (mm/hr)	109
Rational Flow Rate (l/s)	**110**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Pre-Development 10-Year Flow Rate Calculations

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	975.865
Event	10-year	b	4.699
		c	0.760

Site Data

Area (ha)	2.56
Runoff Coefficient	0.20
AC	0.51
Tc (min)	10
Rainfall Intensity (mm/hr)	127
Rational Flow Rate (l/s)	**180**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Storage Calculations for 10-Year Storm Event for Area 201

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	975.865
Event	10-year	b	4.699
		c	0.76

Site Data

Area (ha)	1.37
Runoff Coefficient	0.83
AC	1.13
Tc (min)	10
Time Increment (min)	5
Release Rate (l/s)	52
Storage Required (m^3)	**285**

= 180 - 128

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	127	0.40	239	31	207	
15	101	0.32	287	47	240	
20	85	0.27	322	62	259	
25	74	0.23	350	78	272	
30	66	0.21	373	94	279	
35	59	0.19	393	109	283	
40	54	0.17	410	125	285	********
45	50	0.16	425	140	285	
50	47	0.15	440	156	284	
55	44	0.14	452	172	281	
60	41	0.13	464	187	277	
65	39	0.12	475	203	272	
70	37	0.12	486	218	267	
75	35	0.11	495	234	261	
80	33	0.11	504	250	255	
85	32	0.10	513	265	248	
90	31	0.10	521	281	241	
95	30	0.09	529	296	233	
100	28	0.09	537	312	225	
105	27	0.09	544	328	216	
110	27	0.08	551	343	208	
115	26	0.08	557	359	199	
120	25	0.08	564	374	190	

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SWM DESIGN CALCULATIONS
Post-Development 10-Year Flow Rate Calculations for Area 202 (Uncontrolled)

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	975.865
Event	10-year	b	4.699
		c	0.760

Site Data

Area (ha)	1.19
Runoff Coefficient	0.31
AC	0.36
Tc (min)	10
Rainfall Intensity (mm/hr)	127
Rational Flow Rate (l/s)	**128**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Pre-Development 25-Year Flow Rate Calculations

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1146.275
Event	25-year	b	4.922
		c	0.757

Site Data

Area (ha)	2.56
Runoff Coefficient	0.22
AC	0.56
Tc (min)	10
Rainfall Intensity (mm/hr)	148
Rational Flow Rate (l/s)	**232**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coeffici
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Storage Calculations for the 25-Year Storm Event for Area 201

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1146.275
Event	25-year	b	4.922
		c	0.757

Site Data

Area (ha)	1.37
Runoff Coefficient	0.87
AC	1.19
Tc (min)	10
Time Increment (min)	5
Release Rate (l/s)	70
Storage Required (m^3)	**343**

= 232 - 162

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	148	0.49	295	42	253	
15	119	0.39	355	63	292	
20	100	0.33	400	84	316	
25	87	0.29	435	105	330	
30	78	0.26	464	126	338	
35	70	0.23	490	147	342	
40	64	0.21	512	168	343	********
45	59	0.20	531	189	342	
50	55	0.18	549	210	339	
55	52	0.17	566	231	334	
60	49	0.16	581	252	329	
65	46	0.15	595	273	322	
70	44	0.14	608	294	314	
75	42	0.14	620	315	305	
80	40	0.13	632	336	296	
85	38	0.13	643	357	286	
90	37	0.12	653	378	275	
95	35	0.12	663	399	264	
100	34	0.11	673	420	253	
105	33	0.11	682	441	241	
110	32	0.10	691	462	229	
115	31	0.10	700	483	216	
120	30	0.10	708	504	203	

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SWM DESIGN CALCULATIONS
Post-Development 25-Year Flow Rate Calculations for Area 202 (Uncontrolled)

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1146.275
Event	25-year	b	4.922
		c	0.757

Site Data

Area (ha)	1.19
Runoff Coefficient	0.33
AC	0.39
Tc (min)	10
Rainfall Intensity (mm/hr)	148
Rational Flow Rate (l/s)	**162**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coeffici
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Pre-Development 50-Year Flow Rate Calculations

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1236.152
Event	50-year	b	4.699
		c	0.751

Site Data

Area (ha)	2.56
Runoff Coefficient	0.24
AC	0.61
Tc (min)	10
Rainfall Intensity (mm/hr)	164
Rational Flow Rate (l/s)	**281**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficie
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
Storage Calculations for 50-Year Storm Event for Area 201

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1236.152
Event	50-year	b	4.699
		c	0.751

Site Data

Area (ha)	1.37
Runoff Coefficient	0.87
AC	1.20
Tc (min)	10
Time Increment (min)	5
Release Rate (l/s)	92
Storage Required (m^3)	**351**

= 281 - 189

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	164	0.55	328	55	273	
15	132	0.44	395	83	312	
20	111	0.37	444	110	334	
25	97	0.32	483	138	346	
30	86	0.29	516	165	351	
35	78	0.26	544	193	351	********
40	71	0.24	569	220	349	
45	66	0.22	591	248	343	
50	61	0.20	611	275	336	
55	57	0.19	629	303	327	
60	54	0.18	646	330	316	
65	51	0.17	662	358	304	
70	48	0.16	677	385	292	
75	46	0.15	691	413	278	
80	44	0.15	704	440	264	
85	42	0.14	716	468	249	
90	41	0.13	728	495	233	
95	39	0.13	740	523	217	
100	38	0.13	750	550	200	
105	36	0.12	761	578	183	
110	35	0.12	771	605	165	
115	34	0.11	780	633	148	
120	33	0.11	790	660	129	

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SWM DESIGN CALCULATIONS
Post-Development 50-Year Flow Rate Calculations for Area 202 (Uncontrolled)

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: J.L.
Last Revised: 10-Feb-22

Rainfall Data

Location:	City of Barrie, ON	a	1236.152
Event	50-year	b	4.699
		c	0.751

Site Data

Area (ha)	1.19
Runoff Coefficient	0.35
AC	0.41
Tc (min)	10
Rainfall Intensity (mm/hr)	164
Rational Flow Rate (l/s)	**189**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficie
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

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SWM DESIGN CALCULATIONS
SWM Storage Outlet Structure Calculation

Project Name: 340 Mapleview Drive
Municipality: Barrie, ON
Project No.: 21076
Date: 10-Feb-22

Prepared by: S.C
Checked by:
Last Revised: 10-Feb-22

Return Period	Elevation	Tail Water Elevation	Q_{TARGET}	$H_{ORIFICE\ PLATE\ 1}$	H_{WEIR}	Head Difference to TW	$Q_{ORIFICE\ PLATE\ 1}$	Q_{WEIR}	$Q_{TOTAL\_PROVIDED}$	Required Storage	Storage Provided
	[m]	[m]	[m^3/s]	[m]	[m]	[m]	[m^3/s]	[m^3/s]	[m^3/s]	[m^3]	[m^3]
100YR*	244.40	243.39	0.110	0.949	0.143	1.009	0.029	0.081	0.110	370	N/A
50YR*	244.38	243.39	0.092	0.932	0.126	0.992	0.029	0.063	0.092	351	N/A
25YR*	244.36	243.39	0.070	0.907	0.101	0.967	0.029	0.041	0.070	343	N/A
10YR*	244.33	243.39	0.052	0.882	0.076	0.942	0.028	0.024	0.052	285	N/A
5YR*	244.32	243.39	0.045	0.869	0.063	0.929	0.028	0.017	0.045	243	N/A
2YR*	244.29	243.39	0.034	0.843	0.037	0.903	0.028	0.007	0.034	181	N/A

Reference Points	Elevations (m)
Top of Storage Elevation:	244.40
Bottom of Storage Elevation:	243.39
Weir Invert Bottom:	244.26
Orifice 1 Invert Bottom:	243.39
Max Head:	1.01

Weir		
Bottom Width(m):	Height(m):	Side Slope:
0.45	0.30	3 :1
	INV.=	244.26m

Orifice Plate 1	
Diameter (mm)	120
INV.=	243.39m

Weir equation: $Q = BxC_dxH^{3/2}$ $C_d = 1.7$

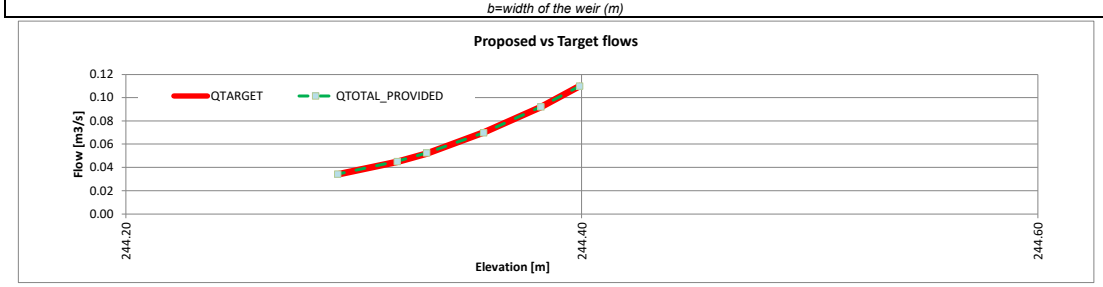
where:
q=flow rate (m^3/s)
h= head on the weir (m)
b=width of the weir (m)
g=9.81 (m/s^2) gravity
C_d = coefficient of discharge

Orifice equation: $Q = C_dxAx(2gH)^{0.5}$ $C_d = 0.6$, $A=(1/4*\pi*D^2)$

where:
q=flow rate (m^3/s)
h= head on the weir (m)
a= area of orifice (m^2)
g=9.81 (m/s^2) gravity
C_d = coefficient of discharge

Emergency Spillway equation: $Q = BxC_dxH^{3/2} + SxC_dxH^{5/2}$

where:
q=flow rate (m^3/s)
h= head on the weir (m)
b=width of the weir (m)
$C_d = 1.5$
S = 5% (20:1)
g=9.81 (m/s^2) gravity
C_d = coefficient of discharge



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Quality Control & Phosphorus Calculations

Ontario
MINISTRY OF THE ENVIRONMENT

Database Version: V 2.0 Release Update
Update Date: 30-Mar-12

Project DEVELOPMENT Summary

DEVELOPMENT: 340 Mapleview Drive
Subwatershed: Lovers Creek

Total Pre-Development Area (ha):	**2.5623**	Total Pre-Development Phosphorus Load (kg/yr):	**0.15**

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
Forest	2.5623	0.06	0.15

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
High Intensity - Residential	1.252	1.32	Vegetated Filter Strips/Stream Buffers	65%	0.58

Uncontrolled area (primarily grass)

High Intensity - Residential	1.3103	1.32	Other	86%	0.24

Controlled area treated by Stormfilter with PhosphoSorb media - Treatment efficiency = 79%+ as per ETV TESTING. Also the downstream natural vegetation acts as a vegetative filter strip. As a treatment train approach this provides 86%.

Post-Development Area Altered:	**2.56**
Total Pre-Development Area:	**2.56**
Unaffected Area:	**0**

	P Load (kg/yr)
Pre-Development:	**0.15**
Post-Development:	**3.38**
Change (Pre - Post):	**-3.23**
2100% Net Increase in Load	
Post-Development (with BMPs):	**0.82**
Change (Pre - Post):	**-0.67**
433.74% Net Increase in Load	

DEVELOPMENT: **340 Mapleview Drive**
Subwatershed: **Lovers Creek**

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	P Load (kg/yr)
Pre-Development:	**0.15**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**0.82**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**-0.67**
Conclusion:	**434% Increase in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

Not approve development as site specific appropriate

Recharge Compensation Form

Application Details	
Site Name (Developer):	
Site Location:	340 Mapleview Drive
File/APID #	
Anticipated Construction Start:	
Subwatershed:	Lovers Creek
Phosphorous Balance	
Kg/year	0.67
Compensation Costs	
Offsetting Value	**2.5**
Compensation Cost (P load *2.5*$35,000)	$58,625.00
Administration Fee (15%)	$8,793.75
Total	$67,418.75

Verification Statement

StormTech Isolator® Row PLUS
Registration number: (V-2020-10-01)
Date of issue: (2020-October-27)

Technology type	Stormwater Filtration Device
Application	Stormwater filtration technology to remove sediments, nutrients, heavy metals, and organic contaminants from stormwater runoff
Company	StormTech, LLC.
Address	520 Cromwell Avenue, Rocky Hill, CT 06067 USA **Phone** +1-888-892-2694
Website	www.stormtech.com
E-mail	info@stormtech.com

Verified Performance Claims

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Based on the laboratory testing conducted, the verified performance claims are as follows:

Total Suspended Solids (TSS) Removal Efficiency - The StormTech Isolator® Row PLUS achieved 82% ± 1% removal efficiency of suspended sediment concentration (SCC) at a 95% confidence level.

Average Loading Rate - Based on the reported flow rate data and the effective sedimentation and filtration treatment area of the test unit, the average loading rate of the test unit was 4.15 ± 0.03 GPM/ft^2 at a 95% confidence level.

Maximum Treatment Flow Rate (MTFR) - Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 gpm/ ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.

Detention Time and Volume - The StormTech Isolator Row PLUS detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 and a detention time of 2.2 minutes.

Maximum Sediment Storage Depth and Volume - The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.

Effective Sedimentation/Filtration Treatment Areas - The Effective Sedimentation Area (ESA) and the Effective Filtration Treatment Area (EFTA) increase as the size of the system increases. For the two overlapping StormTech SC-740 chambers tested, the ESA and the ratio of ESA/EFTA were 54.5 ft^2 and 1.0, respectively.

Sediment Mass Load Capacity - The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs ± 0.8 lbs (2.91 ±0.01 lbs/ ft^2) following a total sediment loading of 195.2 lbs.

Technology Application

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers covered in a non-woven geotextile fabric with a single layer of proprietary woven fabric at the bottom that serves as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal. The following features make the Isolator® Row PLUS effective as a water quality solution:

- Enhanced infiltration Surface Area
- Runoff Volume Reduction
- Peak Flow Reduction
- Sediment/Pollutant Removal
- Internal Water Storage (IWS)
- Water Temperature Cooling (Thermal Buffer).

Technology Description

The Isolator® Row PLUS (shown in Figures 1 and 2) is the first row of StormTech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The Isolator® Row PLUS provides for settling and filtration of sediment as stormwater rises in the chamber and ultimately passes through the filter fabric. The open-bottom chambers allow stormwater to flow out of the chambers, while sediment is captured in the Isolator® Row PLUS.

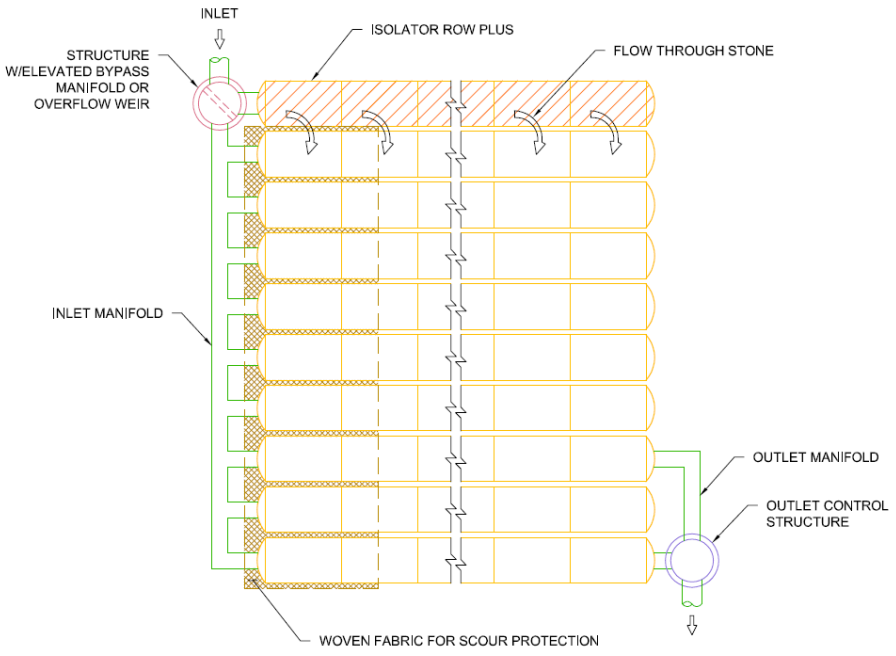

Figure 1: Schematic of the StormTech Isolator® Row PLUS System

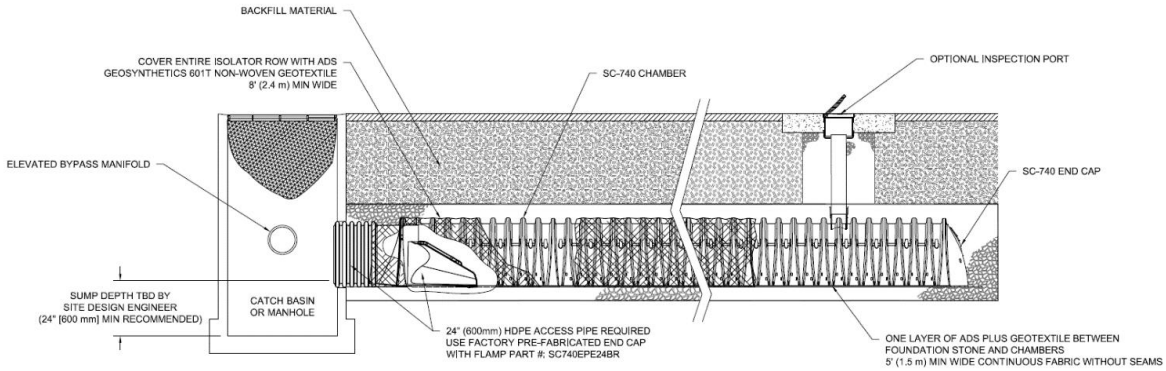

Figure 2: Isolator® Row PLUS Detail

A single layer of proprietary Advanced Drainage Systems (ADS) PLUS fabric is placed between the angular base stone and the Isolator Row PLUS chamber. The geotextile provides the means for stormwater filtration and provides a durable surface for maintenance operations. A 6 oz. non-woven fabric is placed over the chambers.

The Isolator® Row PLUS is designed to capture the “first flush” and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator® Row PLUS but includes a high low/concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator® Row PLUS bypass through a manifold to the other chambers. This is achieved with either a high-flow weir or an elevated manifold. This creates a differential between the Isolator® Row PLUS and the manifold, thus allowing for settlement time in the Isolator® Row PLUS. After Stormwater flows through the Isolator® Row PLUS and into the rest of the StormTech chamber system it is either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

StormTech developed and owns the Isolator® Row PLUS technology and has filed a number of patent applications relating to the Isolator® Row PLUS system.[1]

Description of Test Procedure for the StormTech Isolator® Row PLUS

In January 2020, two overlapping StormTech SC-740 Isolator® Row PLUS commercial size chambers were installed at the Mid-Atlantic Storm Water Research Center (MASWRC, a subsidiary of BaySaver), in Mount Airy, Maryland, to evaluate the performance of the Isolator® Row PLUS system for Total Suspended Solid (TSS) removal (Figure 3) All testing and data collection procedures were supervised by Boggs Environmental Consultants, Inc. (BEC), who was hired by ADS for third party oversight, and were in accordance with the *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January 2013)*.

Prior to the start of testing, a Quality Assurance Project Plan (QAPP), revision dated January 09, 2020, was submitted and approved by the New Jersey Corporation for Advanced Technology (NJCAT), c/o Center for Environmental Systems, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ 07030.

[1] (U.S. Provisional Application No. 62/753,050, filed October 30, 2018; U.S. Non-Provisional Application No. 16/670,628, filed October 31, 2019; International Application No. PCT/US2019/059283, filed October 31, 2019; U.S. Application No. 16/938,482, filed July 24, 2020; U.S. Application No. 16/938,657, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043557, filed July 24, 2020.

Figure 3: StormTech "Isolator® Row PLUS" Test Set-up at MASWRC

Verification Results

The verification process for the StormTech Isolator® Row PLUS technology was conducted by GHL in accordance with the VerifiGlobal Verification Plan for the StormTech "Isolator® Row PLUS" Technology – 2020-09-09. The technology performance claims verified by GHL are summarized at the front of this Verification Statement and in Table 6 on Page 8 under the heading "Verification Summary".

Particle size distribution analysis was performed by ECS Mid-Atlantic, LLC of Frederick, MD in accordance with ASTM D422-63(2007). ECS is accredited by the American Association of State Highways and Transportation Officials (AASHTO).

ASTM D422-63(2007) is a sieve and hydrometer method where the larger particles, > 75 microns, are measured using a standard sieve stack while the smaller particles are measured based on their settling time using a hydrometer.

The PSD meets the requirements of NJDEP, which is generally accepted as representative of the type of particle sizes an OGS would be designed to treat. Actual PSD is site and rainfall event specific, so it was necessary to choose a standard PSD to make testing and comparison manageable.

Table 1 shows the NJDEP PSD specification. Table 2 and Figure 4 show the incoming material PSD as determined by ECS Mid-Atlantic and confirmed by the verifier.

Table 1: NJDEP PSD Specification

Particle Size (µm)	NJDEP Minimum Specification
1000	98
500	93
250	88
150	73
100	58
75	48
50	43
20	33
8	18
5	8
2	3
d_{50}	< 75 µm

Table 2 – Particle Size Distribution (PSD) of Test Sediment

Mesh (mm)	US Sieve Size	Sample ID		
		PSD A	PSD B	PSD C
		Percent Finer		
9.525	0.375	100.0	100.0	100.0
4.750	#4	100.0	100.0	100.0
4.000	#5	100.0	100.0	100.0
2.360	#8	100.0	100.0	100.0
2.000	#10	100.0	100.0	100.0
1.180	#16	100.0	100.0	100.0
1.000	#18	100.0	100.0	100.0
0.500	#35	100.0	100.0	100.0
0.425	#40	93.3	93.0	93.6
0.250	#60	90.3	89.8	90.2
0.150	#100	79.3	78.1	78.1
0.125	#120	73.6	71.7	71.7
0.106	#140	68.4	65.2	64.8
0.090	#170	60.2	58.3	57.5
0.075	#200	52.0	50.9	50.3
0.053	#270	48.0	48.3	47.8
0.045	Hydrometer	46.6	46.7	46.7
0.032		42.8	42.9	41.0
0.021		37.1	37.2	35.3
0.0125		25.7	25.7	25.8
0.0090		20.1	20.1	19.2
0.0064		16.3	16.4	14.5
0.0032		8.8	8.7	7.8
0.0014		3.8	3.7	3.8

The suspended sediment concentration analysis was completed by Fredericktowne Labs Inc., Meyersville, MD. Fredericktown Labs is accredited by the Maryland Department of Environment as Maryland Certified Water Quality Laboratory. The analysis procedure was ASTM D3977-97, Suspended Sediment Concentration. The sampling procedure and submission of samples to the test lab were overseen by the independent observer, Boggs Environmental Consultants, Inc.

All test data and calculations were detailed in the report “NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC”, July 2020, which was submitted to and verified by the New Jersey Corporation for Advanced Technology (NJCAT).

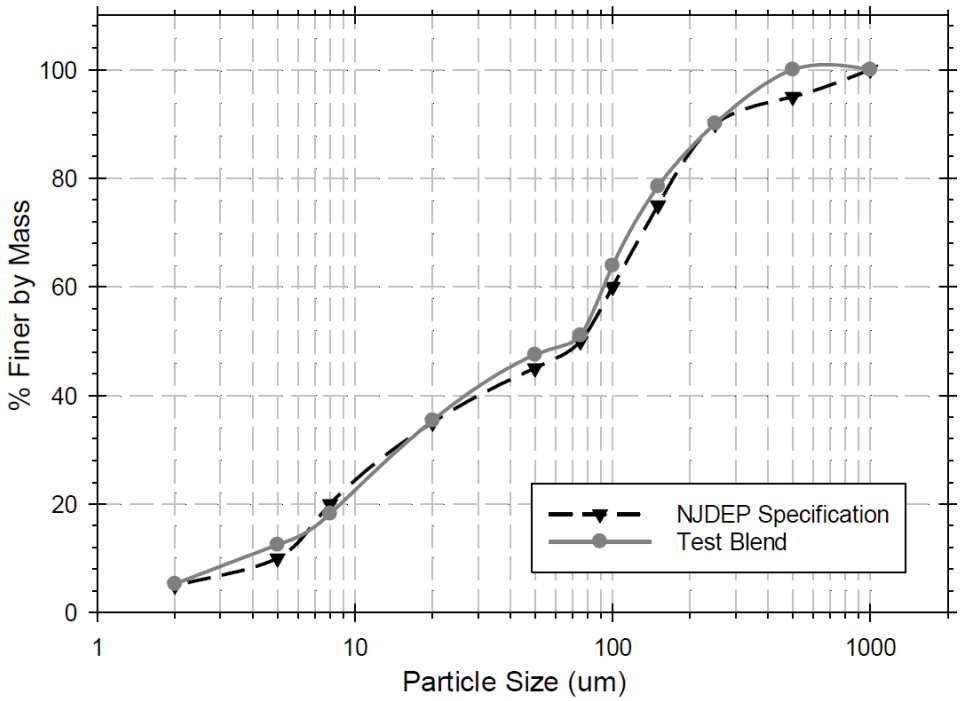

Figure 4– Particle Size Distribution (PSD)

The data in Table 3 (Flow Rate and Temperature) and Table 4 (Removal Efficiency) form the basis for the verified technology performance claim, specifically, flow rate, sediment captured and removal efficiency.

Table 3: Flow Rate and Temperature Summary

Run	Max Flow (gpm)	Min Flow (gpm)	Average Flow (gpm)	Flow COV	Flow Compliance (COV< 0.1)	Maximum Temperature (Fahrenheit)	NJDEP Temperature Compliance (< 80 F)
1	232.8	223.9	226.3	0.0078	Y	48.2	Y
2	228.9	218.6	220.8	0.0104	Y	51.5	Y
3	229.4	220.0	227.2	0.0094	Y	44.7	Y
4	230.2	218.7	223.2	0.0138	Y	40.5	Y
5	228.7	216.9	222.2	0.0103	Y	44.7	Y
6	227.6	217.0	224.2	0.0115	Y	46.7	Y
7	229.7	221.9	226.4	0.0092	Y	44.6	Y
8	230.3	222.2	226.8	0.0089	Y	43.5	Y
9	233.2	218.4	225.6	0.0136	Y	45.5	Y
10	232.2	219.7	228.4	0.0126	Y	44.7	Y
11	226.9	219.2	224.1	0.0088	Y	52.4	Y
12	232.2	222.1	226.9	0.0107	Y	48.5	Y
13	234.7	221.2	226.1	0.0109	Y	48.5	Y
14	231.9	223.4	228.7	0.0103	Y	45.6	Y
15	236.8	224.1	231.4	0.0131	Y	52.2	Y
16	232.5	221.3	229.0	0.0137	Y	47.8	Y

Table 4: Removal Efficiency Results

Run	Average Influent TSS (mg/L)	Influent Water Volume (gal)	Adjusted Average Effluent TSS (mg/L)	Effluent Water Volume (gal)	Adjusted Average Drain Down TSS (mg/L)	Drain Down Water Volume (gal)	Single Run Removal Efficiency (%)	Mass of Captured Sediment (g)	Cumulative Removal Efficiency (%)
1	203	7166	46	6881	34	285	77.8	4282	77.8
2	199	6993	32	6639	27	354	84.0	4415	80.8
3	207	7197	37	6793	27	403	82.6	4654	81.4
4	217	7068	33	6635	29	433	84.9	4923	82.3
5	215	7037	39	6593	29	444	82.2	4705	82.3
6	207	7097	40	6643	31	454	81.2	4504	82.1
7	198	7169	37	6693	30	476	81.6	4386	82.0
8	201	7184	37	6716	32	468	81.6	4473	82.0
9	205	7147	38	6675	30	472	81.8	4539	82.0
10	203	7235	38	6759	31	476	81.4	4523	81.9
11	208	7096	38	6624	30	472	81.8	4567	81.9
12	209	7185	41	6709	30	476	80.7	4584	81.8
13	198	7162	41	6680	32	482	79.7	4277	81.6
14	200	7242	43	6757	34	485	78.8	4318	81.4
15	196	7329	41	6842	32	487	79.5	4320	81.3
16	202	7254	44	6769	31	485	78.9	4384	81.2
Avg.	**204.2**	**7160**	**39**	**6713**	**31**	**447**	**81.2**	**4491**	**N/A**
Cumulative Mass Removed (g)							**71854**		
Cumulative Mass Removed (lb)							**158.4**		
Total Mass Loaded (lb)							**195.2**		
Cumulative Removal Efficiency (%)							**81.2**		

Quality Assurance

Performance verification of the StormTech Isolator® Row PLUS technology was performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. This included reviewing all data sheets and calculated values, as well as overall management of the test system, quality control and data integrity.

Additional information on quality control measures taken can be found in section 5 of the QAPP for StormTech Isolator Row New Jersey Department of Environmental Protection Testing, Rev. 1/9/2020.

Specific QA/QC measures reviewed by the verifier are summarized in Table 5 below.

Table 5. Validation of QA/QC Procedures

QC Parameter	Acceptance Criteria
Independence of observer	Confirmed in letter from Boggs Environmental Consultants, Inc. to NJCAT
Consistency of procedure	Daily logs confirm proper procedure
Existence of QAPP	Confirmed. “QAPP For StormTech Isolator Row New Jersey Department of Environmental Protection Testing”, Rev. 1/9/2020*)*
Use of appropriate sample analysis method – ASTM D3799	Confirmed by method reference on lab reports from Fredericktowne Labs Inc.
Test method appropriate for the technology	Used industry stakeholder approved protocol: *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids*

	Removal by a Filtration Manufactured Treatment Device (January 2013)
Test parameters stayed within required limits	Confirmed in report "NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC", July 2020
Third party verified data	All testing was observed and reviewed by Boggs Environmental Consultants, Inc.

Variance

Performance claims regarding structural load limitations were not verified as they are outside the scope of the performance testing that was conducted in accordance with the 'Quality Assurance Project Plan (QAPP) for StormTech Isolator Row, New Jersey Department of Environmental Protection Testing', revision dated January 09, 2020.

Verification Summary

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers wrapped in woven geotextile fabric with two layers at the bottom that serve as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal.

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Table 6 summarizes the verification results in relation to the technology performance parameters that were identified in the Verification Plan to determine the efficacy of the StormTech Isolator® Row PLUS technology.

Table 6 - Summary of Verification Results Against Performance Parameters

Parameters	Verified Claims	Accuracy
Total Suspended Solids (TSS) Removal Efficiency	Based on the laboratory testing conducted, the StormTech Isolator® Row PLUS achieved an average 82% removal efficiency of SSC	± 1% (95% confidence level)
Average Loading Rate	Based on the laboratory testing parameters, the StormTech Isolator® Row PLUS maintained a loading rate of 4.15 GPM/sf	±0.03 GPM/sf (95% confidence level)
Maximum Treatment Flow Rate (MTFR)	Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 GPM/ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.	± 1.4 GPM (95% confidence level)
Detention Time and Volume	Detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 (based on	N/A

	physical measurement) and a detention time of 2.2 minutes.	
Maximum Sediment Storage Depth and Volume	The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.	N/A
Effective Sedimentation/ Filtration Treatment Area	The effective sedimentation and filtration treatment area increases as the size of the chamber increases. Under the tested conditions using 2 overlapping chambers, the treatment area was 54.5 ft^2	The sedimentation /filtration area was determined from the actual physical dimensions of the test unit*
Sediment Mass Load Capacity	The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs (2.91 lbs/ ft^2) following a total sediment loading of 195.2 lbs	± 0.8 lbs (±0.01 lbs/ft^2) (95% confidence level)

*Note: These numbers are determined based on physical measurement or a dimensional drawing, which is standard practice. Highly accurate measurements are not practical.

In conclusion, the StormTech Isolator® Row PLUS is a viable technology that can be used to remove contaminants from stormwater runoff via filtration. This technology has proven effective at removing suspended sediment from stormwater through in-lab testing using an industry recognized laboratory protocol.

By extension of sediment removal, this technology should also remove particle bound nutrients, heavy metals, and a wide variety of organic contaminants. Performance is a function of pollutant properties, hydraulic retention time, filter media, pre-treatment, and flow rate, such that proper design of the system is critical to achieving the desired results.

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the StormTech "Isolator® Row PLUS" technology, contact:	For more information on VerifiGlobal, contact:
StormTech, LLC. 520 Cromwell Avenue, Rocky Hill, CT 06067 USA t: +1-888-892-2694 e: info@stormtech.com w: www.stormtech.com	VerifiGlobal c/o ETA-Danmark A/S Göteborg Plads 1, DK-2150 Nordhaven t +45 7224 5900 e: info@verifiglobal.com w: www. verifiglobal.com
Signed for StormTech: *Original signed by:* *Greg Spires* Greg Spires, P.E. General Manager	Signed for VerifiGlobal: *Original signed by:* *Thomas Bruun* Thomas Bruun, Managing Director *Original signed by:* *John Neate* John Neate, Managing Director

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

The Stormwater Management StormFilter®

Developed by CONTECH Engineered Solutions LLC
Scarborough, Maine, USA

Registration: GPS-ETV_2020-06-15_TAPE

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

June 15, 2020
Vancouver, BC, Canada

GLOBE PERFORMANCE SOLUTIONS

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Verification Overview

This Environmental Technology Verification (ETV) of The Stormwater Management StormFilter® (StormFilter) is the second part of a two-part verification process and entails the verification of performance claims (#3 – 9) based on field testing data collected in accordance with The Washington State Department of Ecology emerging stormwater treatment technologies, in accordance with guidelines identified by Ecology (2011) in the Technology Assessment Protocol – Ecology (TAPE). This complements the first part of the verification which verifies performance test data collected in accordance with the New Jersey Department of Environmental Protection (NJDEP) *Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January, 2013)*.

Technology description and application

The Stormwater Management StormFilter® (StormFilter) is a manufactured treatment device that is provided by Contech Engineered Solutions LLC (Contech). The StormFilter improves the quality of stormwater runoff before it enters receiving waterways through the use of its customizable filter media, which removes non-point source pollutants. As illustrated in **Figure 1,** the StormFilter is typically comprised of a vault or manhole structure that houses rechargeable, media-filled filter cartridges. Stormwater entering the system percolates through these media-filled cartridges, which trap particulates and remove pollutants. Once filtered through the media, the treated stormwater is discharged through an outlet pipe to a storm sewer system or receiving water.

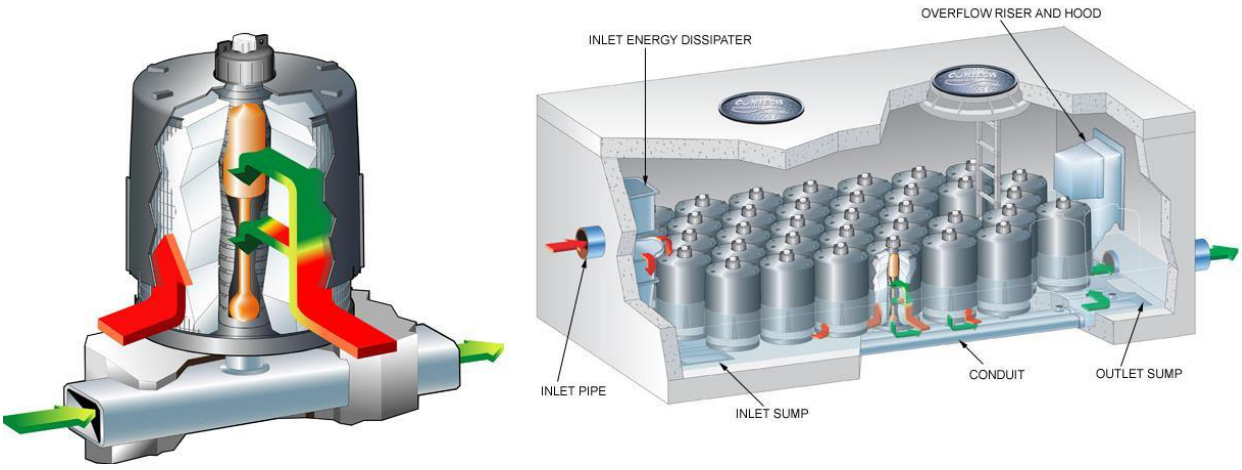

Figure 1 Individual StormFilter Cartridge (Left) and Typical Vault StormFilter Installation (Right)

Depending on the treatment requirements and expected pollutant characteristics at an individual site, the per cartridge filtration flow rate and driving head can be adjusted. The flow rate is individually controlled for each cartridge by a restrictor disc located at the connection point between the cartridge and the underdrain manifold.

Driving head is managed by positioning of the inlet, outlet, and overflow elevations. The StormFilter is typically designed so that the restrictor disc passes the design treatment rate once the water surface reaches the shoulder of the cartridge which is equivalent to the cartridge height. Since the StormFilter uses a restrictor disc to restrict treatment flows below the hydraulic capacity of the media the system

typically operates under consistent driving head for the useful life of the media. Site specific head constraints are also addressed by three different cartridge heights (low drop (effective height of 12 inches), 18, and 27 inches) which operate on the same principal and surface area specific loading rates.

The StormFilter requires a minimum of 1.8 ft, 2.3 ft and 3.05 ft of drop between inlet invert and outlet invert to accommodate the low drop, 18 and 27 inch cartridges, respectively, without backing up flow into the upstream piping during operation. When site conditions limit the amount of drop available across the StormFilter then flow is typically backed up into the upstream piping during operation to ensure sufficient driving head is provided. If desirable the StormFilter can be designed to operate under additional driving head.

The StormFilter is offered in multiple configurations including plastic, steel, and concrete catch basins; and precast concrete manholes, and vaults. Other configurations include panel vaults, CON/SPAN®, box culverts, and curb inlets. The filter cartridges operate consistently and act independently regardless of housing which enables linear scaling.

The StormFilter cartridge can house different types of media including perlite, zeolite, granular activated carbon (GAC), CSF® leaf media, MetalRx™, PhosphoSorb® or various media blends such as ZPG™ (perlite, zeolite and GAC). All of the media use processes associated with depth filtration to remove solids. Some media configurations also provide additional treatment mechanisms such as cation exchange, and/or adsorption, chelation, and precipitation. This verification is specific to a field evaluation of the StormFilter with PhosphoSorb® media.

Performance conditions

The data and results published in this Verification Statement were obtained from the field testing conducted on The Stormwater Management StormFilter® device, in accordance with the requirements outlined by the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology, (WADOE, 2011). Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the State of Washington Department of Ecology.

Performance claim(s)

Performance Claim 3 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 89% removal of total suspended solids at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

Performance Claim 4 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 79% removal of total phosphorus at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

Performance Claim 5 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 56% removal of total nitrogen at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

Performance Claim 6 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 77% removal of total copper at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

Performance Claim 7 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 75% removal of total zinc at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

Performance Claim 8 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 70% removal of total lead at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

Performance Claim 9 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 80% removal of total aluminium at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

Performance results

Performance Claim 3 (TAPE):

Raw data summarizing the percent removal of total suspended solids (TSS) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent TSS (mg/L)	Average Effluent TSS (mg/L)	Percent Removal (%)
LPR021012	182	63.0	65.4
LPR021412	539	32.0	94.1
LPR021712	387	48.0	87.6
LPR022012	246	5.0	98.0
LPR022412	512	43.0	91.6
LPR031012	360	27.0	92.5
LPR031212a	150	18.0	88.0
LPR032912b	370	47.0	87.3
LPR052412	510	43.0	91.6
LPR060112	780	16.0	98.0
LPR060412	580	32.0	94.5
LPR060712	570	120.0	79.0
LPR110612	40.0	10.0	75.0
LPR112312	110	5.0	95.5
LPR113012	230	17.0	92.6
LPR051713	94.0	6.0	93.6
LPR052113	389	24.0	93.8
LPR062513	308	21.0	93.2
LPR013014	170	17.0	90.0
LPR030314	280	95.0	66.1
LPR030814a	173	26.0	85.0
LPR011815	529	72.8	86.2
LPR020215	397	67.0	83.1
Sum	2022		
N (COUNT)	23		
Median	91.6		
STDEV.s	8.99		
VAR.s	80.7		
Z (alpha)	1.65		
Z (beta)	1.29		
Hypothesized median	89.0		

Performance Claim 4 (TAPE):

Raw data summarizing the percent removal of total phosphorus (TP) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent TP (mg/L)	Average Effluent TP (mg/L)	Percent Removal (%)
LPR021012	0.141	0.104	26.2
LPR021412	0.220	0.062	71.8
LPR021712	0.310	0.067	78.3
LPR022012	0.163	0.026	84.1
LPR022412	0.424	0.070	83.5
LPR031012	0.140	0.049	65.0
LPR031212a	0.150	0.037	75.3
LPR032912b	0.280	0.081	71.1
LPR052412	0.170	0.070	58.8
LPR060112	0.200	0.035	82.5
LPR060412	0.210	0.043	79.5
LPR060712	0.170	0.140	17.6
LPR110612	0.068	0.025	63.2
LPR112312	0.082	0.025	69.5
LPR113012	0.170	0.025	85.3
LPR051713	0.282	0.029	89.9
LPR052113	0.558	0.050	91.1
LPR062513	0.583	0.045	92.2
LPR013014	0.317	0.053	83.3
LPR030314	0.417	0.133	68.1
LPR030814a	0.261	0.051	80.3
LPR011815	0.649	0.124	80.9
LPR020215	0.693	0.100	85.6
Sum	1683		
N (COUNT)	23		
Median	79.5		
STDEV.s	18.5		
VAR.s	343.7		
Z (alpha)	1.65		
Z (beta)	1.29		
Hypothesized median	79.0		

Performance Claim 5 (TAPE):

Raw data summarizing the percent removal of total nitrogen (TN) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent TN (mg/L)	Average Effluent TN (mg/L)	Percent Removal (%)
LPR021012	1.06	0.265	75.1
LPR021412	1.20	0.531	55.9
LPR021712	1.58	0.638	59.5
LPR022012	0.696	0.265	61.9
LPR022412	1.11	0.265	76.0
LPR031012	1.72	0.265	84.5
LPR031212a	0.760	0.400	47.4
LPR032912b	1.23	0.265	78.5
LPR052412	1.85	0.400	78.4
LPR060112	2.40	0.872	63.7
LPR060412	1.06	0.327	69.1
LPR060712	0.579	0.555	4.1
LPR110612	0.569	0.555	2.5
LPR112312	0.515	0.515	0.0
LPR113012	1.22	0.515	57.6
LPR051713	1.37	0.250	81.8
LPR052113	0.531	0.248	53.4
LPR062513	0.619	0.253	59.2
LPR013014	0.240	0.212	11.8
LPR030314	0.530	0.230	56.6
LPR030814a	0.432	0.080	81.5
LPR011815	0.180	0.110	38.9
LPR020215	2.32	0.370	84.1
Sum	1281		
N (COUNT)	23		
Median	59.5		
STDEV.s	27.0		
VAR.s	727		
Z (alpha)	1.65		
Z (beta)	1.29		
Hypothesized median	56.0		

Performance Claim 6 (TAPE):

Raw data summarizing the percent removal of total copper (Cu) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent Cu (mg/L)	Average Effluent Cu (mg/L)	Percent Removal (%)
LPR021012	No data	No data	-
LPR021412	No data	No data	-
LPR021712	0.032	0.006	81.3
LPR022012	0.014	0.001	92.9
LPR022412	0.032	0.005	84.4
LPR031012	0.019	0.003	84.2
LPR031212a	0.012	0.003	75.0
LPR032912b	0.023	0.004	82.6
LPR052412	0.050	0.050	0.0
LPR060112	0.040	0.003	92.5
LPR060412	0.021	0.003	85.7
LPR060712	0.028	0.010	64.3
LPR110612	0.006	0.003	50.0
LPR112312	0.006	0.001	83.3
LPR113012	0.016	0.002	87.5
LPR051713	0.016	0.003	81.3
LPR052113	0.027	0.006	77.8
LPR062513	0.029	0.005	82.8
LPR013014	0.021	0.004	81.0
LPR030314	0.019	0.006	68.4
LPR030814a	0.018	0.002	88.9
LPR011815	0.055	0.010	81.8
LPR020215	0.044	0.007	84.1
Sum	1610		
N (COUNT)	21		
Median	82.6		
STDEV.s	20.06		
VAR.s	403		
Z (alpha)	1.65		
Z (beta)	1.29		
Hypothesized median	77.0		

Performance Claim 7 (TAPE):

Raw data summarizing the percent removal of total zinc (Zn) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent Zn (mg/L)	Average Effluent Zn (mg/L)	Percent Removal (%)
LPR021012	No data	No data	-
LPR021412	No data	No data	-
LPR021712	0.151	0.034	77.8
LPR022012	0.076	0.011	85.8
LPR022412	0.191	0.031	84.0
LPR031012	0.120	0.022	81.7
LPR031212a	0.068	0.017	75.0
LPR032912b	0.160	0.029	81.9
LPR052412	0.250	0.250	0.0
LPR060112	0.230	0.012	94.8
LPR060412	0.130	0.015	88.5
LPR060712	0.170	0.048	71.8
LPR110612	0.022	0.014	36.4
LPR112312	0.049	0.010	79.6
LPR113012	0.110	0.016	85.5
LPR051713	0.068	0.010	85.2
LPR052113	0.126	0.021	83.5
LPR062513	0.120	0.017	85.5
LPR013014	0.108	0.026	76.1
LPR030314	0.095	0.029	69.8
LPR030814a	0.088	0.013	84.8
LPR011815	0.151	0.039	74.4
LPR020215	0.192	0.038	80.2
Sum	1582		
N (COUNT)	21		
Median	81.7		
STDEV.s	20.69		
VAR.s	428		
Z (alpha)	1.65		
Z (beta)	1.29		
Hypothesized median	75.0		

Performance Claim 8 (TAPE):

Raw data summarizing the percent removal of total lead (Pb) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent Pb (mg/L)	Average Effluent Pb (mg/L)	Percent Removal (%)
LPR021012	No data	No data	-
LPR021412	No data	No data	-
LPR021712	0.013	0.003	73.7
LPR022012	0.005	0.001	79.6
LPR022412	0.015	0.003	77.3
LPR031012	0.009	0.002	78.5
LPR031212a	0.006	0.002	71.9
LPR032912b	0.012	0.003	75.0
LPR052412	0.025	0.025	0.00
LPR060112	0.016	0.005	68.8
LPR060412	0.013	0.001	90.8
LPR060712	0.013	0.005	62.3
LPR110612	0.001	0.001	0.0
LPR112312	0.002	0.001	50.0
LPR113012	0.005	0.001	80.0
LPR051713	0.004	0.001	74.8
LPR052113	0.009	0.009	0.336
LPR062513	0.009	0.002	82.5
LPR013014	0.006	0.001	80.5
LPR030314	0.007	0.003	62.1
LPR030814a	0.005	0.001	71.5
LPR011815	0.015	0.003	81.4
LPR020215	0.011	0.002	81.0
Sum	1342		
N (COUNT)	21		
Median	74.8		
STDEV.s	28.05		
VAR.s	787		
Z (alpha)	1.65		
Z (beta)	1.29		
Hypothesized median	70.0		

Performance Claim 9 (TAPE):

Raw data summarizing the percent removal of total aluminium (Al) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent Pb (mg/L)	Average Effluent Pb (mg/L)	Percent Removal (%)
LPR021012	No data	No data	-
LPR021412	No data	No data	-
LPR021712	9.15	1.86	79.7
LPR022012	2.62	0.319	87.8
LPR022412	9.65	1.99	79.4
LPR031012	6.20	1.10	82.3
LPR031212a	4.30	0.810	81.2
LPR032912b	6.40	1.70	73.4
LPR052412	9.70	1.30	86.6
LPR060112	11.0	0.370	96.6
LPR060412	12.0	1.00	91.7
LPR060712	9.60	4.10	57.3
LPR110612	1.30	0.300	76.9
LPR112312	1.20	0.190	84.2
LPR113012	3.00	0.440	85.3
LPR051713	1.44	0.134	90.7
LPR052113	3.24	0.358	89.0
LPR062513	3.94	0.466	88.2
LPR013014	3.45	0.796	76.9
LPR030314	2.64	1.13	57.2
LPR030814a	1.67	0.342	79.5
LPR011815	5.32	1.17	78.0
LPR020215	3.85	1.20	68.8
Sum	1691		
N (COUNT)	21		
Mean (AVE)	80.5		
STDEV.s	10.13		
VAR.s	103		
Z (alpha)	1.65		
Z (beta)	1.29		
Hypothesized mean	80.0		

Verification

This verification was completed by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies ("CAWT"), contracted by GLOBE Performance Solutions, applying the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Contech Engineered Solutions LLC to support the performance claim included the following:

- Performance test report "The Stormwater Management StormFilter® - PhosphoSorb® at a Specific Flow Rate of 1.67 gpm/ft^2 – Performance Evaluation Report" prepared by Contech Engineered Solutions, November 8, 2017. This report is based on a field testing program conducted by Contech personnel at a roadway site in Zigzag, Oregon between January 2012 and February 2015. Testing was conducted in accordance with the 2011 version of the Washington Department of Ecology TAPE (TAPE, 2011).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the International Organization for Standardization (ISO). The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

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Appendix D

Hydrogeological Assessment (Excerpts)

Water Balance

1. Climate Information *(for LSRCA use the rate provided on their website)*

Precipitation	914	mm/a	0.91	m/a
Evapotranspiration	545	mm/a	0.55	m/a
Water Surplus	369	mm/a	0.37	m/a

2. Infiltration Rates

Table 2 Approach - Infiltration Factors

Hilly land, average slope of 28 to 47 m per km	0.1
Open Sandy Loam	0.4
Woodland	0.2
TOTAL:	0.7

Infiltration (Infil. Fac - Water Surplus)	258.3	mm/a	0.2583	m/a
Run-off (Water Surplus - B19)	111	mm/a	0.1107	m/a

Table 3 Approach - Typical Recharge Rates

silty sand to sandy silt	150 - 200	mm/a
silt	125 - 150	mm/a
clayey silt	100 - 125	mm/a

The site development area is underlain by silty sand to silty clay till.

Based on the above, the recharge rate is	125	mm/a		0.125 m/a
with runoff of	244	mm/a		0.244 m/a

Property Statistics

3. Pre- Development Site Coverage

Area Covered by Existing Building	0	m^2	0.00 ha
Area Covered by Existing Hard Surface Paving	0	m^2	0.00 ha
Area Covered by Existing Landscaped area	25, 623	m^2	2.56 ha
TOTAL	25,623	m^2	2.56 ha

4. Post-Development Coverage

Area Covered by Building with Additions	6,500	m^2	0.65 ha
Area Covered by Hard Surface Paving	7,000	m^2	0.70 ha
Area Covered by Landscaped Area	12,123	m^2	1.21 ha
TOTAL:	25,623	m^2	2.56 ha

Water Balance

5. Annual Water Balance Before Building Additions

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building (entire site)	0	0	-	-	-	-
Hard Surface Paving	0	0	-	-	-	-
Landscape Area (entire site)	25,623	23,419	13,965		3,203	6,252
TOTAL	**25,623**	**23,419**	**13,965**	**0**	**3,203**	**6,252**

6. Annual Water Balance After Building Additions

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building (entire site)	6,500	5,941	-	-	-	5,941
Hard Surface Paving	7,000	6,398	-	-	-	6,398
Landscape Area (entire site)	12,123	11,080	6,607	-	1,515	2,958
TOTAL	**25,623**	**23,419**	**6,607**	**0**	**1,515**	**15,297**

7. Comparison of Pre-Development (before buidling additions) and Post-Development (after building additions)

	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	23,419	13,965	-	3,203	6,252
Post-Development	23,419	6,607	-	1,515	15,297
				1,688	

8. Requirement for Infiltration of Roof Runoff

Volume of roof (building additions) run-off captured (90%)	5,941 m^3
Volume of post-development infiltration without roof run-off	1,515 m^3
Volume of roof run-off required to match pre-development infiltration rates	1,688 m^3
Percentage of roof run-off (building additions roof) required to match pre-development infiltration	28%